pp. 115—174.] [December 15th, 1912.

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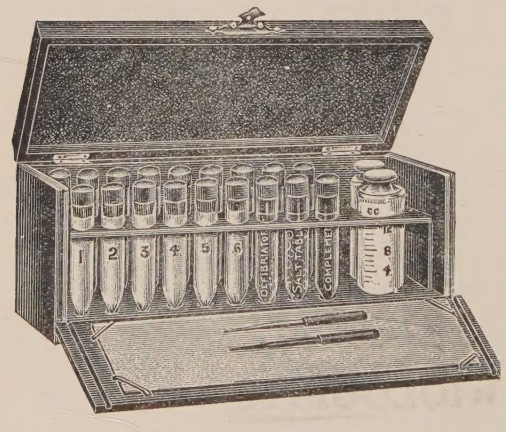

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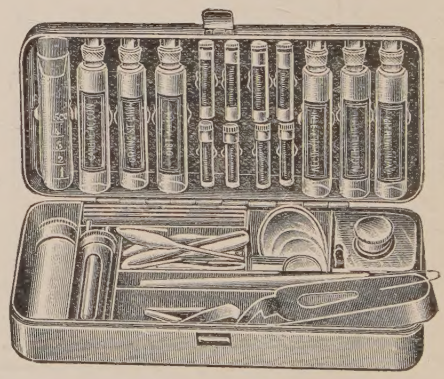

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

Vol. I.] 1912. [No. 3.

MALARIA.

Investigations in India and Malaya.

Paludism: being the Transactions of the Committee for the Study of Malaria in India. 1912. September. No. 5.

This number contains the following original papers:—

(i) Perry (E. L.). Malaria in the Jeypore Hill Tract and adjoining Coast Land; Second *ad Interim* Report. pp. 32-40. (ii) Fry (A. B.). Note on Malaria in Chota-Nagpur. pp. 52-58. (iii) Adie (Helen A.). Distinction of Sex in the Larval and Pupal Stages of Anophelines. p. 41. (iv) Perry (E. L.). The Use of Bile in Insect Dissections. pp. 44-45. (v) Davys (Maud L.). A Note on the Anophelines found in Quetta. pp. 46-51. (vi) James (S. P.) and Stanton (A. T.). Revision of the Names of Malayan Anophelines. pp. 59-63. (vii) Gill (C. A.). Note on the Seasonal Prevalence of Anophelines with Special Reference to the Potentialities of a Single Breeding Place. pp. 65-70. (viii) Fry (A. B.). Indigenous Fish and Mosquito Larvae. (ix) Lalor (N. P. O'Gorman). Note on a Parasitic Fly which infests Malaria Carrying Anopheles in Lower Burma. pp. 42-43. (x) Stanton (A. T.). A Ceratopogon Parasitic upon Anopheline Mosquitos. p. 64.—

(i) Perry gives a table showing the incidence of malaria among the children in three villages. In all, 500 anophelines belonging to species well known to carry malaria were examined without a trace of malarial infection being detected. For 31 successive days anophelines were taken in one cowshed in one of these villages. *Myzomyia culicifacies* was the prevailing species, and daily all females taken of that species were dissected and the condition of the eggs recorded. Previous to dissection the mosquitoes were separated into four grades, according to the condition of the wings. In grade (1) were placed specimens with the wing well marked, and with the wing fringe practically complete. In grade (2) were placed specimens with the wing fairly well marked, but with the wing fringe somewhat worn. In grade (3) were placed

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specimens with the wing decidedly shabby and the wing fringe very much worn. In grade (4) were placed specimens with the wing actually threadbare. *Culicifacies* to the number of 3,757 were thus classified and dissected. CHRISTOPHERS has made the very important observation that occasionally an anopheline omits to lay one or two eggs of a batch and such retained eggs are found among the succeeding batches. Amongst the 3,757 *culicifacies* this phenomenon was observed 21 times. Amongst 1,410 specimens of grade (1) it never occurred. Amongst 1,797 of grade (2) it occurred 12 times, amongst 471 of grade (3) 5 times, and amongst 79 of grade (4) 4 times. From these figures it is obvious that progressive deterioration of the wing is a very useful indication of the relative age of mosquitoes.

The author then moved to Dhooliambo and made a more systematic search for infected anophelines. All these anophelines were taken from native houses in which small children with enlarged spleens slept. The mosquitoes were divided into the four grades described above.

Species.	Grade 1.	Grade 2.	Grade 3.	Grade 4.
Listoni	139	70	17	1
Jeyporiensis	171	54	21	—
Culicifacies	27	5	7	1

Amongst this number 4 salivary glands were found containing sporozoits. They were all specimens of *listoni*, grade 3. The author suggests that it is reasonable to hope that improvement in the technique of salivary gland dissection and the method of grading mosquitoes will materially facilitate the search for sporozoits. Up to date 14 species of anophelines have been taken in the agency.

Two species of worms parasitic in anophelines have been sent to the Central Malaria Bureau. Only one anopheline was found harbouring the first species. The second species appeared to be a large filaria and on some days was present in 5 per cent. of the anophelines taken. It is often $\frac{3}{4}$ inch in length. Infection appears to take place in the larval stage of the mosquito.

(ii) Statistics show that the fever season in Chota-Nagpur is during the latter half of the rains, in the months of August and September.

A spleen census showed that villages fell into two classes, the non-endemic and the hyper-endemic. A table gives the result of the spleen census in the villages of the plains, those at the foot of the Ghats, and those on the plateaux. Children only were examined. The open rice plains of Manbhum and contiguous borders of Ranchi had a village spleen rate of 0 to 6 per cent. The Ranchi plateau gave fairly uniform results of about 7 per cent. The villages at the foot of the Ghats below the plateaux showed hyper-endemic figures of 80 to 100 per cent. spleen rate. Tables are given and maps showing position of the villages.

A list is given of the anophelines found, with notes as to their frequency.

(iii) If an anopheline larva is examined with a strong lens or a 'two-thirds,' a brownish oval tumidity can be made out in males on each side of the 6th abdominal segment. The brownish oval tumidity is the pear-shaped testis with its broad sac. Ovaries and spermatheca are on dissection quite clear in the female pupa.

(iv) A small drop of bile placed on a slide and spread out wets the whole surface of the glass, and water or saline solution placed on the wetted surface spreads out in a uniform film. This use of bile enables a dissector of mosquitoes or other small insects to overcome the difficulty of uneven spreading of fluid on a slide, which is due to the presence of grease.

(v) The Sanitary Officer of Quetta was somewhat at a loss to account for the cases of malaria occurring there. As the sanitary report for 1910 appeared to contain no account of anophelines known to carry malaria the author made a search and found the following: *Myzomyia culicifacies, Neocellia stephensi, Patagiamyia lindesayi, Pyretophorus nursei, Pyretophorus nigrifasciatus.* An account is given of the seasonal prevalence of the adults of each species, and the breeding places of the larvae are described.

The most favourable temperature for the development of the Quetta anopheline appears to be a water temperature of from 68° to 72° F. At this temperature the larval stage is eight days, the pupal stage 36 hours or even less in rare instances.

Throughout this year (1911) at any rate the rise in malaria in Quetta corresponded in the most correct manner with the rise in the numbers of *M. culicifacies* and *N. stephensi*, taken together.

The author also notes that *Stegomyia* are to be obtained close to Quetta.

(vi) James and Stanton give the results of a thorough examination of the mosquitoes left by Dr. Leicester at the Medical Research Institute, Kuala Lumpur. They also examined their own collections. They give a revised list of Malayan anophelines.

(vii) Gill has kept under observation throughout a considerable period a particular breeding place. The observations were made at Muree in the north of the Punjab at a height above sea level of about 7,000 feet. The breeding place was formed of a stone-lined drain 24 feet in length, 18 inches broad and about one foot deep.

The author sums up his observations as follows:—(1) Whilst *P. simlensis, P. lindesayi* and *A. barianensis* are essentially hill species, other species such as *N. willmori* and *M. turkhudi*, which ordinarily occur in the plains, are capable of penetrating under favourable conditions even up to a height of 7,000 feet. (2) The rate of diffusion of anopheles may be greater than might be anticipated from their powers of flight alone.

(viii) Lower Bengal abounds in collections of permanent water which are all potential breeding places for mosquitoes. Fry with the help of Prof. Chowdhury has made a study of the larva-eating species of fish. The following is the list of commonest species found in fresh waters of Bengal:—*Haplochilus panchax, Haplochilus melastigma, Ambassis nama, Ambassis ranga, Anabas*

scandens, Barbus ticto and other species; *Trichogaster,* several species.

The author has records of several hundred tanks and borrow pits and, if it is assumed in all cases that the water is permanent, his experience is as follows:—(1) If free of weed, with clean cut sides, without grass or bush, and with no shelving mud flats, they are always free of larvae. (2) If weed is excessive and thickly matted, both culex and anopheline larvae are numerous. (3) If there is but little weed and the edges are shelving, anopheline larvae only are found. The anopheline being a surface rester can wriggle into shallows where the culex cannot exist. This, the author believes, accounts for the undoubted comparative scarcity of culex in rural areas of Bengal. In other words, without adequate protection from fish mosquito larvae cannot exist.

The author from these observations indicates some practical points. The chief are that tanks and wells should be kept deep and never allowed to dry up, so that the fish may be preserved, and that those responsible should keep them free of weeds. The edges of wells and tanks etc. should be kept steep.

(ix) At Kyaukpyu, Lower Burma, a small fly of the family *Chironomidae,* genus *Ceratopogon,* has been found to infest anopheles of the following local species:—*Nyssorhynchus fuliginosus, Nyssorhynchus karwari, Nyssomyzomyia ludlowi.* It is usually found adhering to the abdomen of the specimens caught in houses. This fly sucks the blood from the stomach through the abdominal wall. Species of Ceratopogon are numerous at Kyaukpyu and bite human beings. It does not appear that much work has so far been attempted in India or Burma with regard to the classification of *Chironomidae.*

(x) Stanton examined for a year the anopheline mosquitoes taken in Pudoh Gaol (Kuala Lumpur, Federated Malay States). On six occasions he found a species of Ceratopogon with its proboscis deeply imbedded in the abdomen of female anophelines which had previously fed on blood; the anophelines were of the species, *N. fuliginosus, N. karwari* and *M. sinensis.*

These findings raise the interesting question as to the part these might take in the transmission of mosquito-borne diseases.

J. G. Thomson.

Diagnosis.

Sinton (J. A.). **Urriola's Test for Malarial Infection.**—*Ann. Trop. Med. and Parasit.* 1912. Oct. 18. Vol. 6. No. 3. B. pp. 375-377.

Urriola stated that if the urine in malarial cases is centrifuged and the deposit examined under a high magnification four types of pigment granules may be found: (1) very fine granules massed together; (2) larger granules arranged in groups; (3) large masses varying in form; (4) granules included within leucocytes and hyaline casts.

Sinton examined the urine of ten cases of malaria. He came to the conclusion that on account of the small number of observations it was impossible to make any definite statement as to the value of URRIOLA's test, but it appeared that:—

"(1) It is almost impossible to exclude the possibilty of the pigment derived from extraneous sources finding its way into the urine, and therefore the presence of small quantities of fairly large masses of pigment appears to me to be of no diagnostic value. (2) The trouble necessary to exclude the possibility of extraneous pigment appears to be too great in comparison with the value of the test. (3) As far as can be concluded from the few cases examined, the presence of pigmented leucocytes or casts appears to be of more value than free pigment in making a diagnosis of present or past malaria, especially in chronic cases. (4) The presence of pigmented leucocytes or casts does not seem to be an indication of active malaria, but rather of the fact that the patient has at some time or other had malaria. Two of the above cases were examined just before being discharged as cured, and one of the above cases had had no signs of malaria for two years, yet they all showed pigmented leucocytes. The presence of such pigment in the urine probably represents an attempt by the body, both during an infection and after the infection has passed off, to get rid of the pigment deposited in the tissues."

J. G. T.

PROPHYLAXIS.

HERRICK (H.). **Prevention of Malaria at Hyderabad, Sind.**—*Jl. R. Army Med. Corps.* 1912. Nov. Vol. 19. No. 5. pp. 551-565. With 1 map and 3 photographs.

The annual rise of the Indus fills the irrigation canals; most of the ground is under water and everywhere suitable breeding places for mosquitoes are found. (A map is given showing the position of the irrigation canals, and tanks always filled with water.) When the author suggested cutting off the water supply there was an outcry that cultivation would be ruined. The difficulty was overcome by repairing a sluice and making the cantonment superintendent responsible for the supply of water to the cultivators, so that only a sufficient amount of water should be let in and no more. Water was thus never left standing more than twenty-four hours in the irrigation channels. The tanks were drained.

The destruction of the mosquito breeding places being completed, a campaign was conducted against adult mosquitoes in houses. Two pounds of sulphur were burnt for each 1,000 cubic feet of space.

Quinine was administered as a prophylactic in doses of 15 grains on two consecutive days to all European troops. It was given in solution with dilute nitrohydrochloric acid. The author says that quinine, given as a prophylactic, must be commenced some months before an epidemic is expected. Care must be taken that no man escapes his dose. To malarial patients in hospital 10 grains of quinine were given two hours before an anticipated attack of benign tertian, and after the temperature was normal 5 grain doses were administered three times a day, for 10 days. Malignant tertian patients received 10 grains of quinine two or three times a day. All malarial patients received an after treatment extending over a period of four months. Nets are provided

in hospital for patients; the ward door is screened and all windows covered with wire gauze.

In the author's experience the greatest incidence of mosquitoes was from September to November, though other officers have noted March and April. The anophelines found were:—*Myzomyia culicifacies, M. rossi, Ch.* [?*C.*] *pulcherrima, Pyretophorus jeyporiensis.*

A table is given showing the admissions of malarial patients to hospital during 1910 and 1911. The figures are small, but the decrease in malaria after the preventive measures carried out is sufficient to justify the value of the methods described by the author.

J. G. T.

WISE (K. S.) & MINNETT (E. P.). **Experiments with Crude Carbolic Acid as a Larvicide in British Guiana.**—*Ann. Trop. Med. and Parasit.* 1912. Oct. 18. Vol. 6. No. 3. B. pp. 327-330.

Paraffin, either in its pure or crude state, and even heavy petroleum oil, is useless as a larvicide in British Guiana, except in a few isolated cases. Most of the ponds, owing to the strong wind always blowing, must be treated with a soluble form of larvicide. Anything floating on the surface of the water, *e.g.* oil, is quickly blown to one side, before its asphyxiating properties come into play. The authors advocate that large areas of water should be kept well stocked with fish and free from floating vegetation. Small pits, foot prints of cattle etc., are treated with crude carbolic.

A series of laboratory experiments is given showing the action of different dilutions of crude carbolic acid, filtered carbolic acid, and pure medicinal carbolic acid. They show that crude carbolic acid is more toxic than the other forms. A dilution of 1 in 20,000 is sufficient to kill all larvae in two hours, but in the case of pupae a much longer time is required.

The authors recommend one teaspoonful of crude carbolic to every two cubic feet of water or one ounce to 16 cubic feet; this gives a dilution of about 1 in 16,000. An animal could drink 12½ gallons of this and take no harm. The water treated has a distinct tarry odour and animals do not drink it readily on that account.

J. G. T.

TREATMENT.

WERNER (H.). **Ueber Neosalvarsan bei Malaria.** [The Treatment of Malaria with Neosalvarsan].—*Deut. Med. Wochenschr.* 1912. Oct. 31. Vol. 38. No. 44. pp. 2068-2069.

Six cases of malaria, four benign and two malignant, were treated with neosalvarsan. Half the patients were given the drug intravenously, the others received an intramuscular injection. The conclusions are as follows:—(1) Neosalvarsan has the same specific action as salvarsan in benign tertian malaria. A dose of 1·5 gm. neosalvarsan corresponds to 1·0 gm. of the "old" salvarsan. (2) The effect is most marked after

intravenous administration, but intramuscular medication is effective. (3) The morphological changes in the benign tertian parasites after neosalvarsan are identical with those observed after salvarsan. (4) In aestivo-autumnal fever the action of neosalvarsan is insufficient; even 1·2 grammes given intravenously has no lasting effect.

J. G. T.

Morbid Anatomy.

Lafora (Gonzalo R.). **On the Changes of the Nervous System in Pernicious Malaria and the Neurological Sequelae resulting from Malarial Toxemia.**—*Jl. f. Psychol. und Neurol.* 1912. Aug. 19. No. 4-5. pp. 209-220. With 7 figures.

It is generally believed that toxins are the etiological factor in the production of the various nervous symptoms in malaria, for similar phenomena are produced in other toxic conditions, *e.g.*, influenza. Certain 'focal symptoms,' hemiplegias or other paralyses, undoubtedly depend upon multiple punctiform haemorrhages in the nerve centres, and subsequent fibrous degeneration.

An interesting pathological feature is that most of the neurological and mental forms do not show the parasite in the peripheral circulation, whereas the vessels of the brain when examined microscopically are found greatly dilated, and filled with large numbers of parasites.

The author gives a full account of three cases. The first was one of malarial coma; the second showed no special neurological or mental symptoms with the exception of stupor, unsteadiness of gait (probably due to weakness) and cerebral vomiting; the third showed a condition affecting the peripheral nerves, and neither stupor nor coma.

In the first two cases post-mortem examinations were made. A detailed pathological account of the nervous system is given. Most of the ganglion cells were much degenerated showing an intense chromatolysis and swelling (acute degeneration). The whole cell appeared filled with small granules instead of Nissl bodies (figure given). The nuclei and nucleoli appeared normal. The neurofibrils were generally degenerated (fibrolysis); only small argentophile granules remained. The neuroglia cells were increased in number, especially in the vicinity of the vessels. In the grey and white matter were numerous large astrocytes showing a cystic condition of their protoplasm. Rod-like cells were found rather abundantly, some of them attached to the protoplasmic processes of the ganglion cells.

The capillary vessels were apparently increased in number and their lumen contained a very large number of parasites. The blood elements differed greatly from normal; large mononuclears of macrophagic variety containing degenerated parasites were extremely abundant. Endothelial cells of the vessel walls were free in the blood current and these also contained parasite inclusions (figured). The same cells in the walls of the vessels were markedly degenerated. These changes in the vascular walls are the cause of the punctiform haemorrhages. The type of parasite found was the aestivo-autumnal. The pia mater was

slightly thickened and contained abundant macrophages and lymphocytes.

The third case, that which showed polyneuritis, had marked wrist-drop. The cause of this condition was probably a post-malarial intoxication affecting especially the peripheral nerves. A very full bibliography is given.

J. G. T.

UNCLASSED.

GIBBON (T. H.). **A Case of Malaria contracted in England.**—*Jl. R. Army Med. Corps.* 1912. Oct. Vol. 19. No. 4. p. 467.

The patient, a young soldier, was admitted to the Military Hospital, Canterbury, on May 21st, 1912. He was born in the village of Lydd, in Romney Marsh, and had been enlisted only for two months. Neither the patient nor any of his family had ever been out of England. The attacks of shivering and the temperature indicated malaria and this diagnosis was borne out by the finding of benign tertian parasites. An interesting history was given which suggested that the patient had a previous attack the previous autumn; several people in the village had a similar illness about the same time. The patient himself called this illness "Marsh-fever."

J. G. T.

MÜHLENS. **Malariaforschung in Jerusalem.** [The Study of Malaria in Jerusalem.]—*Deut. Med. Wochenschr.* 1912. Oct. 24. Vol. 38. No. 43. pp. 2036-2037.

This memoir is a preliminary report of the results obtained by the German expedition to Jerusalem. The blood of 2,839 inhabitants of Jerusalem, Jaffa, and the German Colony of Sarona, was taken for purposes of examination. Of these specimens 2,114 have been examined and 444 shewed parasites. Of the 444 patients 180 were Arabs (Mohammedans), 105 Arabs (Christians), 137 Jews, 22 Europeans (Christians). Benign tertian parasites were found on 185 occasions, malignant tertian on 201, and quartan on 58.

The anopheline most commonly found was *A. bifurcatus.*

J. G. T.

CELLI (Angelo). **La Diminuzione della Malaria in Italia.** [The Diminution of Malaria in Italy.]—*Policlinico.* Sez. pratica. 1912. Oct. 20. Vol. 19. No. 43. pp. 1555-1565.

This paper was read at the International Congress, Washington. Tables are given which show the remarkable diminution in malaria since the introduction of State quinine. The mortality from malaria has fallen from 15,865 to 3,619 yearly. It is demonstrated clearly by statistics and tables that malaria has been reduced amongst the military, the working classes, and farming population.

The work of improving the water supply has not done much to eradicate mosquitoes, especially in the large marshy districts.

J. G. T.

Obst (S.). **Kurze Uebersicht über die Bekämpfung der Malaria in Italien.**—*Wien. Klin. Wochenschr.* 1912. Aug. 15. Vol. 25. No. 33. pp. 1257-1258.

A short review of the antimalarial campaign in Italy.

J. G. T.

Sinton (J. A.). **Some Attempts at the Cultivation of the Malarial Parasite by Bass's Method.**—*Ann. Trop. Med. and Parasit.* 1912. Oct. 18. Vol. 6. No. 3. B. pp. 371-373.

In none of the author's cultures was he able to satisfy himself that any increase, either in number or size, occurred in the parasites, although they persisted in some of the culture tubes for a very long time; attempts at subculture also failed. No marked difference was observed between the cultures kept aerobically and those kept anaerobically. At the time this paper was written, Bass had not yet published full details of his technique. (See this *Bulletin*, No. 1, p. 22.) [Sinton did not use glucose in his medium.]

J. G. T.

Schnee. **Über Mücken in Saipan.** [Mosquitoes found in Saipan.] —*Arch. f. Schiffs. u. Trop. Hyg.* 1912. Oct. Vol. 16. No. 20. p. 710.

The only *Culicidae* occurring in Saipan (one of the Marianne or Ladrone Islands, Pacific) were *Culex* and *Stegomyia.* Anophelines were entirely absent. Malaria never spread although infected persons were being imported from the Bismarck Archipelago. The author refers to the danger of yellow fever occurring after the opening of the Panama Canal.

J. G. T.

Smith (F.). **Malarial Coma mistaken for Drunkenness.**—*Jl. R. Army Med. Corps.* 1912. Oct. Vol. 19. No. 4. pp. 463-465.

The author describes a case of malarial coma which was mistaken for drunkenness. The administration of quinine rapidly cured the patient.

J. G. T.

Carazzi (D.). **Il Problema della Malaria.** [The Malaria Problem.]—*Gazz. d. Ospedali e. Clin.* 1912. Aug. 25. Vol. 33. No. 102. pp. 1057-1063.

The author believes that man may be only an incidental host of the malarial parasite and that it is therefore necessary to search in malarious districts for another animal host.

J. G. T.

SLEEPING SICKNESS.

Transmission.

Rodhain (J.), Pons (C.), Vandenbranden (J.), & Bequaert (J.). (i.) **Contribution au Mécanisme de la Transmission des Trypanosomes par les Glossines.**—*Arch. f. Schiffs. u. Trop. Hyg.* 1912. Nov. Vol. 16. No. 21. pp. 732-739. With 2 figures. (ii.) **Les Trypanoses Animales au Bas-Katanga et leur Rapport avec les Glossines (3e note*)**—*Trypanosoma Denysi* **(n. sp.) Parasite de l'Ecureuil Volant.**—*Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 608-611.

(i.) After an account of the conclusions reached by Kleine, Bruce and his collaborators, and Roubaud on the infective forms of trypanosomes in tsetse flies and of the experiments by the two last observers of the injection of salivary glands and proboscides into susceptible animals, the authors point out that these injection experiments failed in precision because, besides trypanosomes, the organs contained other forms of the parasites. In order to determine more exactly what forms are poured into the blood by the infective tsetse, the authors made flies known to be infective suck shed blood which they could examine immediately afterwards. It is admitted, they point out, that tsetse flies cannot feed except on blood in the vessels which is at a certain pressure. They therefore devised the following apparatus.—The lower end of an ordinary graduated one cc. pipette was fixed into a small glass cylinder, one cm. in diameter, by means of a rubber stopper and over the lower end of this cylinder a piece of fine skin, preferably that of a rat or mouse, was stretched and secured over a rubber ring, inner surface outwards. (See figure.) Citrated blood was put into the cylinder and rose in the pipette to a height which could be regulated. It is clear that the fluid in contact with the membrane was at a pressure determined by the height of the fluid, and that this could be measured as well as the amount taken up by the flies. With this apparatus they found that flies biting upwards through the membrane can feed at a pressure which is quite small; more than a hundred so fed. A table is given showing the result of an experiment in which ten flies sucked in turn through the membrane till the pipette was empty. Another experiment showed that flies could feed when the column of fluid above the skin was not more than 3·5 mm. in height. Afterwards they were fed as a

* The second note of these authors was noticed in *Sleeping Sickness Bulletin.* Vol. 4. p. 213.

rule on the cylinder containing citrated blood to a height of 10 mm. The average amount of blood taken up by the flies was found to be 0·056 cc., maximum 0·091.

The authors next ascertained what forms and number of trypanosomes were poured into the fluid by an infective fly. In the course of experiments on the transmission of *T. brucei* (*pecaudi*) by *G. morsitans* an infective fly was isolated after it had infected four mice. The apparatus was filled with the citrated blood of a baboon under a pressure of 19 cm. [? mm.] and the fly was made to suck through the membrane. The blood contained in the cylinder was then centrifuged and the trypanosomes were counted with the Thoma-Zeiss apparatus. 1,562 were found and as some fluid was lost this was evidently a low estimate. After this count and the preparation of two slides the remainder of the fluid was inoculated into a mouse, which became infected. The parasites are figured and are described as 'salivary trypanosomes,' such as are found in the hypopharyngeal tube. Compared with *T. brucei* in the blood of mammals they are smaller and are distinguished by their narrow membrane and small undulations. Thirty specimens averaged 16·1μ in length and 1·5μ in breadth, the free part of the flagellum being 4·5μ. The length varied from 11 to 20μ. The infective fly was afterwards killed and found to have a generalised infection; that is to say, one of the intestine and proboscis, the hypopharynx being filled with small salivary trypanosomes. Trypanosomes of the intestinal type were not seen at all in the slides.

(ii.) This note deals with *Trypanosoma brucei* (or *pecaudi*) and its transmission by *G. morsitans* in nature and in the laboratory. This trypanosome was found in the blood of a dog and of a goat. *Glossina morsitans*, used for breeding purposes, were fed upon the goat and many became infected. A transmission experiment was made with 29 bred flies; after a latent period of eighteen days one became infected and produced infection in goats and other animals. On dissection it was found to have a total infection of the intestine and proboscis. The authors therefore have shown the existence of three types of trypanosomes pathogenic to stock in Lower Katanga, namely, *T. cazalboui* (*vivax*), *T. congolense* (*pecorum* of Bruce), and *T. brucei* (or *pecaudi*). These three species are here transmitted by *Glossina morsitans*.

In the second half of the paper the trypanosome of a flying squirrel is described. It is a large parasite 37 to 48μ in length and 2 to 4μ in breadth, with free flagellum measuring 8 to 10μ. The blepharoplast, 7μ in front of the pointed extremity, is large, measuring as much as 1μ. The trypanosome was constantly seen in the blood of the squirrel, which lived for three days.

[The method of feeding tsetse flies invented by these authors is very ingenious and can be easily practised. The pipette is unnecessary unless it is wished to measure the blood ingested. Experiments can now be devised which will give us precise knowledge of the infective forms of trypanosomes.]

A. G. B.

KINGHORN (Allan) & YORKE (Warrington). **Further Observations on the Influence of Meteorological Conditions on the Development of *Trypanosoma rhodesiense* in *Glossina morsitans*.**—MS.

The authors refer to their previous paper on this subject (see this *Bulletin* No. 1, p. 43) and cite the conclusions. Further experiments indicate decisively that the development of *T. rhodesiense* in *G. morsitans* is directly dependent on the temperature to which the flies are subjected. 680 flies in all have been used in six attempts to transmit the human trypanosome on the Congo-Zambesi watershed at temperatures ranging from 59° to 65° without a single infective fly being obtained, whereas of 330 flies used in the Luangwa Valley six and probably ten became infective, the mean temperature ranging from 75° to 84°.

The incubator experiments described in the previous paper were repeated, laboratory-bred flies being now used. Attention is drawn to the fact that the low temperature on the plateau in the cold season was unfavourable to the pupation of *G. morsitans*. So slow was the process that the authors were unable to obtain sufficient flies; many which did emerge were malformed. They therefore placed the pupae, some of which had been deposited two months before, in the incubator at 85° F. and within three or four days a large number of flies were procured. A fresh experiment is detailed and this and the two previous ones are shown in a table. It is seen that of 189 flies used (133 wild and 56 bred) 2·6 per cent. became infective. As however 40 per cent. of the wild flies died in a week owing to the abrupt change of temperature, as contrasted with the ten per cent. of the bred flies, the figure is corrected to 3·3 per cent., which is close to that obtained in the valley experiments. An experiment done to determine if the relative humidity of the atmosphere was of importance seemed to show that it did not exert any appreciable influence on the developmental cycle.

An experiment to ascertain more definitely the influence of temperature is so interesting that it is given here—

Two batches of wild *G. morsitans*, batch A 95 flies, batch B 119, shown to be non-infective by feeding upon clean monkeys, were fed for three days on a *rhodesiense*-infected guinea-pig. Each batch was then fed on a healthy monkey until the fortieth day, the mean temperature being 59°. Neither monkey became infected. The 42 flies remaining of batch A were placed in the incubator at 85° and the 58 flies of batch B were left at laboratory temperature. Of the batch A flies on the 43rd day only six were alive. From the 41st to the 47th day the flies of batch A were fed on a monkey (which died); from the 48th day on a rat. The rat became infected, showing that batch A contained an infective fly on the 48th day, eight days after being placed in the incubator. The four flies still alive on the 53rd day were fed on four clean rats, three of which became infected.

On the 61st day the 38 flies of batch B, which had then failed to infect the monkey, were put in the incubator at 83°, and from that day till the 75th were fed on a healthy monkey. The animal unfortunately died. All the flies were dissected as they died. One was found to harbour trypanosomes in the salivary glands and gut, and animals inoculated with the contents became infected. In the first part of the experiment the relative humidity in the incubator was 36 per cent., in the second 72 per cent.

The experiment shows that the earlier stages of development can occur at a comparatively low temperature and trypanosomes

can persist in this stage for sixty days, but for the completion of the cycle the temperature must be raised (75°-85°). These results are believed to give a satisfactory explanation of the failure of KLEINE to transmit *T. gambiense* by *G. morsitans* on the Victoria Nyanza, *viz.* that the temperature was not high enough. They are considered also to afford an adequate explanation of the extremely long latent periods of trypanosomes in Glossina, which have occasionally been observed.

[Drs. KINGHORN and YORKE may be held to have established their point, and the study of transmission data obtained with other trypanosomes by observers at different levels makes it probable that temperature has a direct influence on the cycle in the invertebrate in all cases. The practical bearing is evident.]

A. G. B.

Professor E. A. MINCHIN in his Report to the Committee of the Tropical Diseases Research Fund for the year ending June 30th, 1912, describes observations made in collaboration with Dr. J. D. THOMSON upon the transmission of the rat trypanosome by the rat flea. He alludes to the work of NÖLLER, who concluded that the flea transmits the rat trypanosome through its faeces, which are licked off by the rat. (See *Sleeping Sickness Bulletin* Vol. 4, p. 215.) Minchin writes that even if this is a possible mode of infection he and THOMSON are by no means convinced that it is the usual one. They have shown that the stumpy trypanosome, which is the end of the development, is formed in the rectum; if this is destined to pass out with the faeces, there is no reason why it should migrate forward to the stomach, as they have shown it to do. They note also that NÖLLER used the dog flea, not the rat flea. They have carried out experiments of feeding a known-infective flea on a healthy non-infected rat, the flea being watched through a hand lens; up to the date of writing these experiments had given no positive results. It has been previously shown that trypanosomes become non-infective 48 hours after being taken up by the flea. Experiments were done to determine the point of time at which the infectivity is lost. It was found to be a little over half an hour.

Development.—Of fleas fed on an infected rat only about one in five or six becomes infective; 80 to 84 per cent. are immune. If, however, the fleas are examined 24 hours after feeding, trypanosomes will be found in all. Many of these, therefore, are destined to degenerate. It is necessary to distinguish between the developmental series, which leads to the trypanosome establishing itself in the flea, and the degenerative series, destined to disappear. The process of degeneration is described. The degenerative forms are to be found chiefly in the rectum, and are especially abundant 18 or 24 hours after the flea has fed on the infective rat. They show a great tendency to attach themselves by the flagellum. They have the kinetonucleus posterior to the nucleus, while in the developmental forms the reverse is usually found; they show no signs of multiplication, whereas the developmental forms do. The developmental series may be divided into the stomach phase and the rectal phase. The chief feature of the

stomach phase is that the trypanosomes penetrate into the epithelial cells and undergo multiplication by multiple fission. This intracellular multiplication may go on for about three days. The final product of the stomach phase is a long active form with the two nuclei more or less approximated. It is these forms which pass down into the rectum; the authors have seen them in the act. From them are produced the little pear-shaped forms which constitute the typical rectal phase. These are attached in vast numbers to the wall of the rectum; they multiply by binary fission, and become transformed into the stumpy trypanosomes.

Dr. WENYON (same Report) has confirmed NÖLLER's observation that the rat is infected by the dog flea with *Trypanosoma lewisi* not by the act of biting, but by the rat licking the faeces passed by the flea. He has, moreover, transmitted this trypanosome by the same method by means of the human flea (*Pulex irritans*). The infection is maintained even if the flea is fed on a human being, so that fresh human blood does not appear to be destructive to these forms in the flea.

A. G. B.

DIAGNOSIS.

DUBOIS (Albert). **Notes sur l'Autoagglutination des Hématies dans la Trypanosomiase Humaine.**—*Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 686-690.

The author has studied autoagglutination in African natives between slide and coverslip and by YORKE's method. When employing the usual method he classifies the phenomenon as '*forte*,' '*nette*,' and '*faible*,' according to its degree. He gives a series of tables. No. 1 is of non-treated sleeping sickness patients; of 38 all showed the phenomenon in the first or second degree. No. 2 shows the results with 24 treated patients; there was some degree of agglutination in all but one; it was never of the first degree, and in a few cases it was of the third. No. 3 shows the same for natives in good health; of 32, 22 showed the second degree of agglutination, three the third degree, and seven none at all. A fourth table gives the same data for twenty patients suffering from various diseases. In one case there was no autoagglutination; in the others the phenomenon was present, several times in the first degree. A fifth table gives the results with seventeen natives, infected and uninfected, citrated serum or plasma being mixed with an emulsion of red cells (after YORKE); the results were similar. The author has had no opportunity of studying the phenomenon in white patients. He has tried to make the blood of an animal autoagglutinate by injecting various chemicals into it, but without success. He concludes that the absence of autoagglutination is strongly presumptive of the absence of trypanosomiasis, but that its presence, in the Congo native at any rate, does not lead to any diagnostic conclusion. He suggests that the frequency of the phenomenon at Leopoldville may be due to the multiplicity of parasites and parasitic diseases to which the natives are subject—malaria, entozoa, filaria, syphilis and yaws.

A. G. B.

LANFRANCHI (A.). **Sur le Diagnostic des Trypanosomiases. Essais d'Identification des Différents Trypanosomes.**—*Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 611-614.

The author states that he has succeeded in immunising dogs against nagana. He has put the serum of such dogs in contact with the serum of rats, guinea-pigs and dogs infected with *Trypanosoma brucei* and *T. equiperdum* and has obtained an agglutination reaction, a precipitation reaction, and one of complement fixation. His conclusions are to this effect—

(1) The agglutination reaction obtained by the employment of serums of animals hyperimmunised against a given trypanosome does not enable one to identify the trypanosome. (2) The precipitation reaction under certain conditions allows a differential diagnosis between *T. brucei* and *T. equiperdum*. (3) The complement fixation reaction enables one to diagnose trypanosomiasis, but not to differentiate between these two species.

A. G. B.

TREATMENT.

BRODEN (A.), RODHAIN (J.), & CORIN (G.). **Le Salvarsan et la Trypanose Humaine.**—*Arch. f. Schiffs. u. Trop. Hyg.* 1912. Nov. Vol. 16. No. 22. pp. 749-779.

In this paper an account is given of the treatment of African sleeping sickness patients at Leopoldville, Belgian Congo, in 1910. The preparation and method of employment of the salvarsan solution are described, its action on the trypanosomes and on the human organism, the duration of its sterilising action, and its curative action. The salvarsan was the original form. It was used for the most part in intravenous injections given in sterile saline solution. This medium was found most convenient in Tropical Africa and intravenous injection was preferred to intramuscular because of the absence of pain. A preliminary trial showed that a dose below 0·01 gm. per kilo. caused the disappearance of trypanosomes in from fifteen minutes to less than an hour. The drug was very well tolerated. It seemed to act on the lymphatic glands less quickly than other organic arsenicals. It caused in the natives an increase of weight and an accession of strength.

To test the duration of the sterilising action eight persons received a single dose intravenously (0·4-0·6 gm.). The experiment was controlled here and throughout the work of the authors by the cytological and chemical condition of the cerebro-spinal fluid. Relapses were looked for by blood examination. The authors think that the thick film method is quite unreliable; they draw off 10 cc. of blood and centrifuge three times, repeating the process as a rule once a week. Relapses occurred after 27, 35, and 37 days; in three cases there was no relapse after three to three and a half months. The three patients who relapsed early had a large percentage of cells in the cerebro-spinal fluid. Similar results were obtained in the case of five patients who had intramuscular injections. From the two series of experiments it was

concluded that salvarsan acts best in patients in the first stage, that is to say, in those whose cerebro-spinal fluid is not changed cytologically.

The drug was then used on patients (1) by itself, (2) with trypaflavin, (3) with trypaflavin and tryparosan. A table gives the data for 38 patients who were treated with salvarsan alone. It shows the state of the cerebro-spinal fluid before treatment; the doses and dates of the injections (either one or two); the date of relapse, if such occurred; the state of the cerebro-spinal fluid at a stated interval after treatment; and the result. Doses of one gram were given in many instances. In the consideration of the results the patients are divided into those with changed cerebro-spinal fluid and those with normal cerebro-spinal fluid; in the latter class are put all in whom the cells did not exceed ten per cmm. Of the fifteen patients in the first class only two improved. Of the 22 in the second class three who received small doses had a relapse, three disappeared, in two instances the results were doubtful, and thirteen were in a state of apparent cure at periods varying from three and a half months (two cases) to fourteen and a half months. The authors note that they use the expression 'apparent cure' if a certain time after the cessation of treatment the clinical state is good, there is no gland enlargement, no trypanosomes are found in the blood after centrifugation, and the cerebro-spinal fluid is normal.

Twenty-five patients were treated with salvarsan and trypaflavin. This dye is given in intravenous injections dissolved in saline solution. The doses were small as it appears to be irritating to the kidneys. The results are summed up as before. Of nine patients with changed cerebro-spinal fluid five had much improved (12 to 25 cells per cmm.). Of fifteen patients with normal cerebro-spinal fluid nine were apparently cured (four to twelve months' observation). A table is given.

Seventeen patients had tryparosan as well as trypaflavin and salvarsan. Reference is made to a previous communication on tryparosan (see *S. S. Bulletin*, Vol. 2, p. 171). Eight or nine gm. of this substance were given daily for three successive days. It is ingested in gelatine capsules. The natives were kept at the laboratory from six a.m. to midday and made to swallow a capsule once an hour. The procedure was to give an intravenous injection of trypaflavin on the first day; on the second, third, and fourth day tryparosan; and on the fifth and sixth day intravenous injections of salvarsan. Only two patients with an altered cerebro-spinal fluid were treated; they were not improved. In the other category there were thirteen. One died from an unknown cause four months after treatment; the other twelve were in a state of apparent cure after four months (seven cases) to ten months (three cases). It is noted that though the percentage of successes is apparently high the periods of observation were short. The treatment is described as *très énergique*.

The results of the three methods of treatment are summed up. It is concluded that when the nervous centres have undergone a marked change one cannot hope for cure after short and energetic treatment, but when they are slightly implicated, when the

spinal fluid contains only a slight increase of cells, recovery may be hoped for. As regards the other category of patients all cannot be cured, but a considerable proportion may hope for recovery. The authors think that patients in whom apparent cure has been maintained for at least eight months are definitely cured. Putting the figures together one gets the result that in fifty patients treated at the first stage seventeen remained well for at least eight months, that is, a proportion of 34 per cent. To the objection that the results might have been improved by a longer continued treatment the authors reply that their object was to test the possibility of obtaining prompt cure in a certain class of patients.

Finally, they conclude that salvarsan given for sleeping sickness has a rapid and energetic action on *T. gambiense*; that on the patient himself its action is beneficial; and that, given by itself or with dyes, it produces in a good proportion of cases at the first stage *therapia sterilisans magna.*

[This valuable paper should be consulted in the original. There is an impression that salvarsan has no great value in human trypanosomiasis. From the published papers one gleans that it has not been tried systematically except in some advanced or previously treated cases. There can now be no question of its value, at least in the case of Congo natives.]

A. G. B.

Trypanosoma rhodesiense.

Stephens (J. W. W.) & Fantham (H. B.). *Trypanosoma rhodesiense* **(Stephens and Fantham): a Second Species of African Trypanosome producing Sleeping Sickness in Man.**—*Brit. Med. Jl.* 1912. Nov. 2. pp. 1182-1183.

After an account of what led up to the description of this trypanosome as a new species the authors summarise the evidence in favour of its being new. The chief points on which they lay stress are the morphology; the animal reactions, for which they quote Laveran; the serum reactions (action of immune serum, of baboon and human serum, the trypanolytic reaction); and cross immunity experiments. As secondary characteristics they give the mode of transmission and the curve of measurements. In conclusion they express the belief that the disease has existed in Rhodesia and Nyasaland from time immemorial.

A. G. B.

Mesnil (F.). *Trypanosoma rhodesiense* **and** *Trypanosoma gambiense.*—*Brit. Med. Jl.* 1912. Nov. 2. pp. 1185-1186.

The author gives an account of the work done at the Pasteur Institute, Paris, on these two trypanosomes. He concludes—

"1. That there is a marked differentiation between the two human trypanosomes of Africa, and that the creation of a new species for the trypanosome of Rhodesia is rendered legitimate.

"2. But that these two species are more closely allied to each other than any other two known species of trypanosome."

A. G. B.

T. GAMBIENSE IN THE TISSUES.

WOLBACH (S. B.) & BINGER (C. A. L.). (i.) **A Contribution to the Parasitology of Trypanosomiasis.**—*Jl. Med. Research.* 1912. Sept. Vol. 27. No. 1. (New Series, Vol. 22. No. 1.) pp. 83-107. (ii.) **A Contribution to the Pathological Histology of Trypanosomiasis.**—*Brit. Med. Jl.* 1912. Nov. 2. p. 1188.

The authors have studied the distribution of trypanosomes in tissues and have tried to ascertain the factors concerned in the production of the lesions of trypanosomiasis. For this purpose they have modified Giemsa's method. This modification, which is too long to quote, gives, according to the authors, the same staining of trypanosomes as is obtained in film preparations. If fixation has been immediate and the sections cut are not thicker than 2 μ, the flagellum, undulating membrane, cytoplasm, nucleus, and blepharoplast are all clearly defined.

The material consisted of two strains of trypanosomes: one of *Trypanosoma brucei*, originally from Uganda, and one of *Trypanosoma gambiense* from the French Congo. The animals used were white rats, guinea-pigs, and monkeys. No external lesions, other than emaciation, were seen in any of the experimental animals except in one monkey and six guinea-pigs infected with *T. gambiense*. The monkey, which was inoculated on April 1st, developed oedema of the eye lids on May 2nd, and rapidly became moribund. In the six guinea-pigs with external lesions no trypanosomes were found in the blood. The lesions are described in detail. The authors believe that they are the first to record such extensive gross external lesions in guinea-pigs infected with *T. gambiense*.

The pathology and distribution of the trypanosomes in the heart, lung, spleen, liver, gastro-intestinal tract and kidney, etc. are given in detail. The brains of three monkeys and four guinea-pigs infected with *T. gambiense* were studied. In two cases microscopic lesions of the brain were found in monkeys; the blood of these animals when killed contained many trypanosomes.

The lesions in the first monkey were slight. In the other monkey they were more widely distributed, being found in sections from several different areas of the cerebrum, the base of the brain and in the pia covering the pons. The lesions consisted of infiltrations of the pia-arachnoid with endothelial and lymphoid cells, an increase of the subpial neuroglia, and a few perivascular infiltrations of endothelial and lymphoid cells. A rare plasma cell also occurred in the infiltrations.

Trypanosomes were found in considerable numbers in the infiltrated areas in the pia-arachnoid, in the subpial neuroglia tissue, in the perivascular infiltrations, in perivascular spaces not infiltrated, in the walls of small blood vessels and capillaries, and in foci scattered throughout the substance of the brain. In one instance a trypanosome was found in a ganglion cell. In the substance of the brain they were most numerous in the neighbourhood of blood vessels. The most marked lesions and greatest number of trypanosomes occurred in the region of the sulcus cruciatus.

As regards the morphology of the trypanosomes in the tissues, the authors state that by far the greatest number of those seen

in sections and in contact film preparations are normal and dividing flagellate forms. These were found lying in tissue spaces, between cells and between collagen fibrils of connective tissue. Occasional flagellate forms in phagocytes were seen.

The summary of the paper in general terms is as follows:—The production of extensive skin lesions with giant cell formation in guinea-pigs infected with *T. gambiense* is of interest. The abundance of trypanosomes in the lesions of these animals and the scarcity in the blood is similar to YORKE's findings in the case of *T. rhodesiense* infected goats. The initial cell reaction is the proliferation of endothelial cells. The finding of numerous intravascular mitoses of endothelial cells in lung, liver, spleen, and kidney indicates the source of the increase of large mononuclear leucocytes in the blood in human trypanosomiasis. The sequence of pathological change is invasion of tissues by trypanosomes, oedema (not constant), endothelial cell infiltration, lymphoid and plasma cell infiltration, and fibrosis. The absence of granular leucocytes in all lesions is worthy of notice. Phagocytosis of trypanosomes takes place almost exclusively by endothelial cells.

In all animals infected with *T. brucei* and *T. gambiense*, lesions have been found in practically every organ, and trypanosomes have been found in these lesions. The most common seats of lesions are the connective tissue structures, and trypanosomes are found more abundantly in fibrous connective tissue than in any other place before the occurrence of the lesions. This preference for connective tissue heightens the numerous analogies between syphilis and trypanosomiasis. The failure of trypanosomes to invade the epidermis in the *T. gambiense* guinea-pigs is in marked contrast to the behaviour of the spirochaetes of syphilis, yaws and tropical ulcer. The character of the initial cell reactions, endothelial and lymphocyte, and the absence of polymorphonuclear and granular leucocytes, if comparisons with reactions to bacteria are valid, indicate a very low degree of toxicity of trypanosomes.

The paper is illustrated with six plates containing many excellent photomicrographs. Sections of spleen, liver, kidney, lung, and skin are shown. In many of these the trypanosomes are very distinctly seen, while figures from the cerebrum of a monkey infected with *Trypanosoma gambiense* show the position of the parasites in the tissues in a very convincing manner.

The final conclusions are given thus:—

"In trypanosomiasis the trypanosomes do not remain confined to the blood vessels and lymphatics. They invade the connective tissue structures of all organs, the reticular tissue of lymph nodes and spleen, and the substance of the brain.

"The lesions of trypanosomiasis are due to the presence of the trypanosomes in the tissues.

"The most common form of trypanosome in tissue, and we believe the one most active in the production of lesions, is the flagellate form."

G. C. L.

SCHIZOTRYPANUM CRUZI IN EXPERIMENTAL ANIMALS.

da ROCHA-LIMA (H.). **Ueber das Verhalten des Erregers der brasilianischen Trypanosomiasis des Menschen in den Geweben.** [The Behaviour of *Schizotrypanum cruzi* in the Tissues.]—*Verhandlungen der Deutsch. Patholog. Gesellsch.* (15. Tagung). 1912. pp. 454-459.

In this paper, read before the German Pathological Society, the author gives an account of observations made by M. MAYER and himself on *Schizotrypanum cruzi* in the tissues. The strain was obtained in a guinea-pig and the tissues were studied principally in infected monkeys, and also in white mice. The chief seat of the parasites in the tissues was the striped muscles. They were found constantly in the fatty tissues, especially in fat cells with small fat droplets, and also in cells of the connective tissue, especially that beneath the epidermis. It is noted that VIANNA does not mention multiplication in the fatty tissue or connective tissue, so that one cannot say if this occurs in man; the examination of these tissues is very often neglected. Other sites not mentioned by VIANNA are lymphatic glands, bone marrow, spleen, and the unstriped muscle of the intestine and arteries. As regards the pathological anatomy there are three possibilities. The parasites may be in the cells without causing any lesion, or there may be lesions caused by the presence of the parasite, or lesions which have no direct connection with these. In the last case the appearances are attributed to the action of toxins. There follow details of the microscopical appearances of the various tissues. No parasites were found in the thyroid gland. Six photomicrographs illustrate the paper.

A. G. B.

DELANOË (M. & Mme. P.). **A propos du** *Schizotrypanum Cruzi.*—*Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 599-602.

This paper is described as a commentary on the 27 text-figures which illustrate it. Fourteen of these represent different phases of the cycle of development of *S. cruzi* in the muscles. There are seen to be leishmanial forms, leptomonas forms, crithidial forms, and trypanosome forms. The authors have not observed dimorphism in these developmental forms, as did MAYER and DA ROCHA LIMA. Dimorphism, they say, appears only at the trypanosome stage. They note, however, that in experimental animals the dimorphism tends to become less marked. They agree with BRUMPT that CHAGAS' males are young forms and his females the older ones.

Other figures show developmental forms met with in the blood of two mice, and numerous trypanosome forms not undergoing division. They believe that the forms in the blood are merely those of the muscles which have become free in the general circulation. In the blood of the same mice they noted the presence of developmental forms in large mononuclear leucocytes and macrophages; they did not think this an instance of phagocytosis. Other figures show forms met with in culture. Here

blood trypanosomes soon became transformed into leishmanial forms, but trypanosomes may be met with in cultures four to five days' old. *S. cruzi* cannot be carried on by cultures. The authors did not succeed in infecting two adult mice with a culture 45 days' old. They note that CHAGAS obtained varying results in the inoculation of cultures, but does not mention their ages.

A. G. B.

BLANCHARD (Maurice). **Marche de l'Infection à *Schizotrypanum Cruzi* chez le Cobaye et la Souris.**—*Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 598-599.

Two guinea-pigs infected with *Schizotrypanum cruzi* were received from the Oswaldo Cruz Institute. Trypanosomes had disappeared from their blood on the 44th day after arrival. One was reinoculated in the peritoneum four times but never became infected; it was apparently immune. The other, having shown no trypanosomes between the 44th and 67th days, was killed and its blood introduced into two guinea-pigs; one of these became infected. Three other guinea-pigs infected from the same animal died on the 34th, 43rd, and 127th days. Seven passages were made in mice; the trypanosomes increased rapidly without crises, till death on the fifteenth or twentieth day.

A. G. B.

SLEEPING SICKNESS IN UGANDA.

In his Annual Medical Report for the year 1911 Dr. A. D. P. HODGES writes that sleeping sickness is decreasing everywhere except in the Nile Province, where it is stationary, and on Lakes Edward and George. A table is given of the deaths from sleeping sickness in the Protectorate during the years 1905 to 1911 (compare *Sleeping Sickness Bulletin*, Vol. 3, p. 430). The total for 1910 was 1,546, that for 1911 is 1,487. The deaths in Buganda and Unyoro respectively have decreased by about half; those in Busoga have risen from 698 to 1,013, an increase attributed by Hodges to increased accuracy in the native returns. The figures from the other parts of the Protectorate are incomplete. Of the 253 deaths in the kingdom of Buganda 151 were among the islanders and 102 among the inhabitants of the mainland.

Under the heading Sanitation an account is given of the preventive measures. It is noted that the porter traffic between Uganda on the one hand and the Lado Enclave and Belgian Congo on the other has been stopped in the former case and strictly limited in the latter. Other details given are of local interest. Reference is made to Mr. PASKE SMITH's report (see *S. S. Bulletin*, Vol. 4, p. 241). It is noted that the co-operation of the Belgian Government is essential for effective control in the region of Lake Edward.

Under the heading Hospitals it is stated that up to November 30th, 1911, 7,362 cases had been received into sleeping sickness camps; 280 cases remained under treatment at that date, all at Chagwe camp. The admissions during the year were 153. A

table shows the condition of all the patients treated. Another table shows the condition of the survivors of the 489 cases admitted to Chagwe camp during 1907 (see *S. S. Bulletin,* Vol. 3, p. 309).

Condition.	A.	B.	C.	Died.	Absent.	Total.
November 30th, 1909	40	21	9	—	—	70
" " 1910	4	13	15	27	11	70
" " 1911	8	8	9	38	7	70

Of these cases, admitted in the early stage of the disease, 6·5 per cent. survive, of whom 1·6 per cent. remain in the 'A' class. In treatment, preparations of organic arsenic have had the best results.

Finally, an account is given of the investigations undertaken during 1911. The presence of new fly areas is noted and of small fresh foci of infection.

A. G. B.

Unclassed.

Vix (W.). **Psychiatrisch-neurologischer Beitrag zur Kenntnis der Schlafkrankheit nach Beobachtungen in den Schlafkrankenlagern Kigarama und Usumbura in Deutsch-Ost-Afrika und aus dem Laboratorium der Kgl. psychiatr. u. Nervenklinik zu Breslau (Geh. Rat Bonhöffer).** [Psychiatry and Neurology of Sleeping Sickness.]—*Arch. f. Psychiatrie u. Nervenkrankheiten.* 1912. Vol. 50. No. 1. pp. 1-30.

The observations recorded in this paper were made in the course of a stay at two sleeping sickness camps in German East Africa. Material was obtained also from post-mortem examinations for investigation at home. Seventy patients were studied, all at a more or less advanced stage of the disease; all had been treated by atoxyl. Trypanosomes were found in 65, either in the blood or cerebro-spinal fluid; it was doubtful whether two of the others had sleeping sickness at all. During the author's stay lumbar puncture was done on 27 cases; trypanosomes were found in 21. In all these the cells were increased in number. Psychical phenomena were observed in 55. Only five had sleep symptoms. The nervous and mental symptoms are described and analysed. A symptom seen sixteen times was exophthalmos, usually associated with acceleration of the pulse. This syndrome persisted in several cases in which recovery is believed to have taken place; there was never enlargement of the thyroid gland. An account is given of each case, headed by the most prominent psychical or physical symptom and, finally, an account of the microscopical findings in the nervous tissues of three cases in which a post-mortem examination was made.

[The occurrence of exophthalmos in nearly 23 per cent. of cases of advanced sleeping sickness is remarkable. This symptom has not been recorded, to the writer's knowledge, before.]

A. G. B.

KLEINE (F. K.). **The Identity and Mode of Transmission of Trypanosomes.**—*Brit. Med. Jl.* 1912. Nov. 2. pp. 1183-1185.

R. KOCH expressed the view that the pathogenic trypanosomes had not yet acquired the position of fixed species, but were in a period of mutability. In Kleine's opinion this period is passed. He knows of no case in which one has been able fundamentally to alter the whole character of a strain. Moreover, all attempts to alter the specificity of a trypanosome in the body of Glossina have proved fruitless. He instances experiments in which *G. palpalis* were fed for a long time on infected and clean sheep and goats, and afterwards, to test their infectivity, on monkeys and clean goats; the trypanosomes remained far more infective for monkeys than for goats. In many cases inoculation into animals is enough to establish the specificity, but it is necessary to proceed in a uniform way. The chief points, according to Kleine, are that the quantity of the blood introduced should be 5 to 20 cc.; as many animals as possible must be injected; the injection must be subcutaneous; and, to determine whether it is positive or not, thick drops must be used for the blood examinations. He does not think the thick film method is sufficiently appreciated. He believes that when, using a technique free from all objection, one fails to infect a species of animals by subcutaneous injection with trypanosome-containing blood that species is insusceptible. He quotes a paper by DUTTON, TODD, and KINGHORN in which they appear not to hold this view. He notes that the motility of individuals of the same strain is not always the same. Slight motility does not, for instance, exclude a trypanosome from the *cazalboui* group. Sluggish movement may be due to the formation of antibodies.

In respect to other methods of identification there is the cross inoculation method, the disadvantages of which the author names, and serum reactions. The advantage of serum diagnosis is that one can use the serum of relatively immune animals. Serum diagnosis is valuable in the identification of human trypanosomes. As regards the development in the body of Glossina, Kleine is convinced that it is a sexual one; he regards the types of trypanosomes found as male and female. He does not believe that infection of the salivary glands is necessary for the flies to become infective; he suggests that the salivary glands may be infected secondarily from the proboscis. With regard to the cases of sleeping sickness in Nyasaland and on the Rovuma river and the belief that the disease could not spread in the absence of *G. palpalis*, he suggests that the epidemic was accidentally recognised just at the moment when it was about to migrate from West to East Africa.

A. G. B.

DUKE (H. L.). **A Camel Trypanosome, with some Remarks on the Biometric Method of Diagnosing Trypanosomes.**—*Proc. Roy. Soc.* 1912. Oct. 31. Series B. Vol. 85. No. B 583. pp. 563-568.

The trypanosome was obtained from the blood of a camel from Boran. Its morphology and measurements are given. 443

G. palpalis were used in transmission experiments; there was no case of successful transmission and no flagellates were found in the flies. A table shows the results of animal inoculations. The diagnosis is discussed, and it is concluded that, though not a typical *T. evansi*, it is probably that species.

In the remainder of the paper the question of the biometric method of diagnosing trypanosomes is discussed from the point of view of a worker in the field. The biometric method is considered of undoubted value in discriminating between two such species as *T. vivax* and *T. uniforme*, where the difference in size is one of the most important points of distinction. In the case of other mammalian trypanosomes, including *T. brucei*, *T. gambiense*, *T. evansi*, and others, exhaustive measurements are considered of little use. Thus, the diagnosis of *T. brucei* and *T. evansi* in reality turns upon the minimum measurements of the two species.* The measurements obtained for the various species vary with the observer and with the stage of the cycle.

With reference to the STEPHENS-FANTHAM method of measurement and the criticisms of those writers on BRUCE's method, it is contended that the criticisms, though doubtless true as regards geometrical exactitude, are irrelevant as regards practical application. Other considerations which make the biometric method inconstant are mentioned, and it is suggested that the refinements introduced by the above workers are not essential, the chief requisite being that the measurements are made in a constant manner.

A. G. B.

BRAUN (Hugo) & TEICHMANN (Ernst). **Versuche zur Immunisierung gegen Trypanosomen.** [Experiments of Immunisation against Trypanosomes.]—1912. Jena: Gustav Fischer. 108 pp. [Price 3·50 M.]

This Memoir is divided into six sections. In the first the methods employed for vaccination in trypanosomiasis are discussed. They are classed in two groups according to whether living or dead trypanosomes were used. An account is given of the authors' process. The second section contains an account of their own experiments. Eight strains were employed: two of dourine, one of caderas, two of nagana, one of *T. congolense* and two of *T. gambiense*. The subject is discussed under the headings active and passive immunity. The third section deals with the question of specificity of trypanosomes; the next with serum fastness; the fifth with complement fixation. The following are some of the conclusions—

(1) Trypanosomes obtained pure and killed by drying form an antigen with which mice, rats, guinea-pigs, and rabbits can be surely protected against trypanosome infection. (2) Toxins are not demonstrable in dried nagana and dourine trypanosomes. (3) The quantity of vaccine needed to obtain immunity is considerable and varies for the different animal species. (4) Both the saline extract of the vaccine and the residuum contain antigen. (5) The duration of the immunity varies with the individual. (6) Immune serums can be obtained from rabbits by means of the vaccine. (7) Serum-fastness is an acquired, not a permanently heritable property.

* See curves in *Reports of Sleeping Sickness Commission of Royal Society.* 1912. No. 12. p. 18.

(8) The antigenic property of serum-fast strains may be very small. (9) The trypanosomes of dourine, nagana, and mal de caderas possess with respect to immunity many properties in common. Whether this holds good also for *T. gambiense* and *T. congolense* is uncertain. (10) Serums from rabbits and cattle sick of nagana and from rabbits infected with mal de caderas contain antibodies against the same serum-fast strains as in the case of rabbits infected with dourine. The serum-fast modifications of these three species of trypanosomes are therefore identical. (11) By means of the complement fixation method no differences can be demonstrated between the trypanosomes of nagana, dourine, and mal de caderas, and between their serum-fast modifications. (12) Pure carbolised suspensions of trypanosomes can be used for diagnostic purposes.

Many tables are given in the course of the Memoir.

A. G. B.

BETTENCOURT (A.) & BORGES (I.). **Présence de Trypanosomes dans le Sang des Bovidés Portugais.**—*Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 603-604.

For the last two years the authors have tried to obtain evidence of the presence of trypanosomes in the blood of cattle killed at the Lisbon abattoir. They used the cultural method. Eighty animals were examined without result during the months January to April and November to December. The technique is given. In June, 1912, positive results were obtained in three of eleven cattle examined. The cultural forms are said to be identical with those described by most authors. Crithidial forms predominated. In one culture, seven to eight days old, typical trypanosomes were met with. The endoleucocytic forms described by BEHN were not seen.

A. G. B.

ROSENBLAT (Stephanie). **Über die Wirkung von gallensauren Salzen auf Trypanosomen.** [The Action of Bile Salts on Trypanosomes.]—*Arch. f. Anat. u. Physiol.* (Physiol. Abt.) 1912. No. 3-4. pp. 188-190.

The blood of mice infected with nagana was mixed with bile salts in various dilutions in test tubes. At intervals of five minutes the blood was examined fresh and stained. It was found that in certain dilutions the bodies of the trypanosomes were promptly dissolved, the last parts to disappear being the flagellum, blepharoplast, and nucleus. Experiments to ascertain whether this was a simple solution or a more profound change led the author to the belief that the change in the constituents of the trypanosomes must be profound. Experiments of treating infected mice with the above salts were without result.

A. G. B.

KINGHORN (Allan) & YORKE (Warrington). **Trypanosomes infecting Game and Domestic Stock in the Luangwa Valley, North-Eastern Rhodesia.**—*Brit. Med. Jl.* 1912. Nov. 2. pp. 1186-1188.

This paper appears to correspond in all essentials with one published in the *Annals of Tropical Medicine*, Vol. 6, No. 3. A. (see *Sleeping Sickness Bulletin*, Vol. 4. p. 321).

A. G. B.

YAWS.

DEGORCE & MOUZELS. **Le Pian chez les Annamites du Tonkin.**—*Bull. Soc. Med.-Chirurg. de l'Indochine.* 1912. Oct. Vol. 3. No. 8. pp. 548-557.

This paper contains a detailed account of the clinical features of yaws presented by the Annamites. Amongst the natives the disease is known as "ghe còc," which signifies Toad's scab, and it is believed to be an act of vengeance by a dragon whose veins have been cut by the making of new roads.

The description of the clinical symptoms differs considerably from that of most authors; it resembles most closely the description given by CASTELLANI and CHALMERS. The malady is very contagious and when one member of a family becomes infected the remainder usually take the disease within a few months. In families it is generally the young children that first become infected, and they transmit the disease to their mother who infects the father. The yaws of Tonkin appears to differ from that described from other localities in the following main points:—The inconstancy of granulomata of the typical framboesial type; the frequence of lesions belonging to the circinate type; and the relative frequence of lesions of the scalp and scrotum.

Although it differs from syphilis in many points, the two diseases offer many analogies and the authors believe that yaws is really a form of syphillis modified by passage through different races. In Tonkin its symptoms seem to resemble those of syphilis much more closely than in many other regions. The authors state that the disease is readily cured in Tonkin by injections of arsenobenzol.

The article is accompanied by figures illustrating some of the circinate type of lesions.

Edward Hindle.

STIBBE (E. Philip). **A Clinical Note on Yaws in the Pacific, with Consideration of its Relationship to Syphilis.**—*S. African Med. Rec.* 1912. Oct. 12. Vol. 10. No. 19. pp. 418-419.

The author briefly discusses some of the clinical features of yaws in the Fiji Islands. Notes are given of four cases that presented lesions closely resembling syphilis, all of which were improved by treatment with increasing doses of potassium iodide.

In considering the relationship of yaws and syphilis the author lays emphasis on two facts:—(1) Fijians are apparently immune to syphilis and (2) practically all Fijians sooner or later acquire yaws. Consequently, it is suggested that the two diseases are related somewhat on the same lines as vaccinia and small-pox, and that an attack of yaws confers immunity against syphilis.

E. H.

EXPERIMENTAL.

RANKEN (H. S.). **A Note on "Granule-Shedding" in** *Treponema pertenue.* [Memoranda.]—*Brit. Med. Jl.* 1912. June 29. p. 1482.

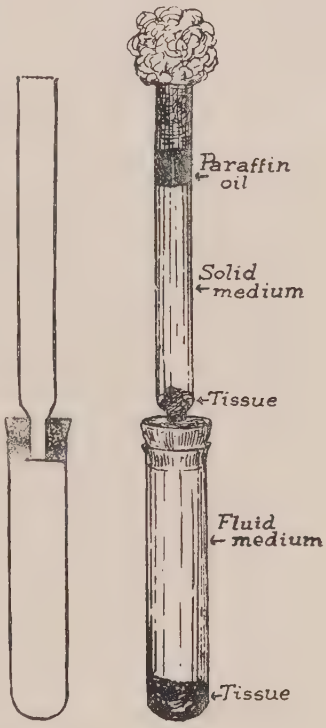
On examination of the spirochaete of yaws by means of the dark ground illumination, the author was able to observe the extrusion of small, highly refractile granules.

This species is said not to present any cork-screw motion like that of *T. pallidum*, nor any progressive motion. The granules are shot out by the lateral motion and immediately after extrusion are stationary, but they soon begin to rotate and make their way through the surrounding fluid. Although they are motile there is no suggestion of a flagellum being present.

E. H.

NOGUCHI (Hideyo). **A Method for Cultivating** *Treponema pallidum* **in Fluid Media.**—*Jl. Exper. Med.* 1912. August. Vol. 16. No. 2. pp. 211-215. With 1 text-figure.

The necessary apparatus consists of two tubes, the upper one being connected with the lower by means of a tube passing through a rubber stopper. The arrangement and relative sizes of these tubes are shown in the accompanying diagram. Both tubes are carefully sterilised, and in the lower one is placed one or two pieces of fresh sterile rabbit's kidney. The tube is then corked by the insertion of the upper half of the apparatus and a piece of sterile kidney put in the upper tube. The lower tube is now filled, by means of a pipette, with ascitic fluid or a mixture of ascitic fluid and bouillon. The syphilitic material is then inoculated into this liquid in the lower tube, and, in addition, some of it is poured over the tissue in the upper tube. Into the latter is now poured a mixture of 1 part ascitic fluid with 2 parts of slightly alkaline agar; this solidifies in the upper tube and when solid is covered with a layer of sterile paraffin oil. The whole is then incubated at 37° C.



This method is said to be very suitable for *Treponema pallidum*, *T. microdentium*, *T. macrodentium*, *T. refringens*, *T. mucosum* and *T. pertenue*.

E. H.

CASTELLI (G.). **Experimentelle und Chemotherapeutische Versuche bei Framboesia Tropica.** [An Experimental and Therapeutical Study of Yaws.]—*Zeits. f. Chemotherapie.* 1. Teil. Orig. 1912. Vol. 1. No. 2. pp. 167-201. With 4 plates.

After a short summary of the previous work on the experimental transmission of yaws to animals, the author mentions the work of NICHOLS, who was able to infect rabbits by intratesticular injection and also by subcutaneous injection into the scrotum.

Castelli has repeated this work and was able to produce typical chancres on the scrotum of rabbits by means of subcutaneous inoculations. The chancre developed after a variable incubation period, and by means of rapid passages through rabbits the virulence of the strain could be increased, as evidenced by the shortening of the incubation period. In addition rabbits were infected by intravenous injection of an emulsion of the testicle of a rabbit containing numerous spirochaetes. The method of administration was as follows:—The testicle of a heavily infected rabbit was ground up in normal saline, the whole being kept at 37° C., and after straining through muslin, the emulsion, containing numerous living spirochaetes, was injected into the superficial ear vein of a young rabbit. The first animal was injected on October 7th, 1911, a second time on November 8th, and again on November 25th. On December 10th a papule appeared at the base of the right ear, and on examination by means of puncture numerous spirochaetes were found at this site. In all, nineteen rabbits were infected in this manner, sometimes after only one injection, but more often after two or three. In those rabbits that became infected after one injection the incubation period varied from six to nine weeks. The symptoms are somewhat variable, but the first evidence of infection is generally the appearance of cutaneous papules on the head, and subsequently the animals always developed secondary symptoms, usually in the form of gummatous ulcers of the nasal cavity. In a few cases the testicles and scrotum were affected; only rarely was keratitis observed.

Rabbits infected with yaws both intratesticularly and intravenously, were treated by means of salvarsan and neosalvarsan respectively. The results obtained were very remarkable and show that both these drugs are very effective in the treatment of this disease. Neosalvarsan is to be preferred because of its slight toxicity, the *dosis tolerata* for a rabbit being 0·3 gms. per kilogram, whereas for salvarsan it is only 0·1-0·11 gms. per kilo. The action of neosalvarsan on localised infections of the scrotum is well shown in the case of three infected rabbits which received injections of 0·035 gms., 0·02 gms., and 0·015 gms. per kilo. respectively. In the first, the spirochaetes disappeared after three days and the chancre in 24 days; in the second the corresponding intervals were four days and 34 days; and in the last, five days and 25 days respectively. The effects of these compounds on rabbits infected intravenously were even more remarkable and in no case has any relapse been observed. The *dosis sterilisans* of neosalvarsan is only one tenth of the *dosis tolerata*.

Finally, Castelli discusses the question of the possible identity of yaws and syphilis and points out that up to the present, with the doubtful exception of serum diagnosis, there is no sure method of distinguishing these two infections. The general symptoms, papules, etc., following the intravenous injection of *T. pertenue* (yaws) into rabbits are so different from those after a similar injection of *T. pallidum* (syphilis) that the author believes that this method may be of use for differentiating them.

The paper is illustrated by excellent plates showing the development of papules on infected rabbits and other pathological features of the experimental infections.

E. H.

TREATMENT.

SABELLA (Pietro). **La Framboesia Tropicale a Tripoli e la sua Cura col Neo-salvarsan.**—*Policlinico.* Sez. pratica. 1912. August 25. Vol. 19. No. 35. pp. 1261-1265.

The author gives an account of the treatment of ten cases of yaws with intravenous injections of neosalvarsan. The treatment was most successful, one of the most striking examples being that of a family, father, mother and a 13 year old son, all suffering from the disease. The father was covered with nodules and had been affected for five years, during which time he had tried all the native specifics without effect. The mother suffered from a simple nodular eruption diffused over the whole body, whilst the boy presented a few lesions about the scrotum and between the thighs, and the anus was surrounded by a papillomatous eruption. The father received 0·70 gms. of neosalvarsan intravenously, and the other two patients 0·40 gms. each. The effect of the drug was marvellous. In 15 days the father was completely cured; the others in shorter periods.

With the exception of the above cases all the patients received 0·40-0·50 gms. of neosalvarsan intravenously. To only one patient was it necessary to give a second injection, in all the other cases the cure being effected by a single dose.

In addition, the author discusses prophylactic measures against this disease in Tripoli. He points out the necessity of strictly isolating all cases and at once treating them by means of arsenicals.

E. H.

BORN. **Salvarsan bei Syphilis und Frambösie.**—*Arch. f. Schiffs- u. Trop. Hyg.* 1912. August. Vol. 16. No. 16. pp. 560-562.

This article contains an account of the treatment of 10 cases of syphilis and one of yaws by means of intra-muscular injections of '606.' A three year old boy suffering from yaws was injected with 0·2 gms.; eight days later the pustules, which previously covered his body, had disappeared except for slight discolourations of the skin. An abscess formed at the site of injection and had to be removed; the wound did not heal for some weeks.

E. H.

PERRY (A.). **Report by the Principal Civil Medical Officer on the Use of Salvarsan (606) in the Treatment of Yaws. Ceylon.** Received in Colonial Office, September 28th, 1912.

The results recorded in this report show that salvarsan is an effective cure for yaws (known as "parangi" in Ceylon) in every stage of the disease, with the possible exception of tertiary cases

in which destruction of bone has occurred. Cases treated with one injection seven months previously have shown no tendency to relapse. In all, 54 cases were treated, adult men and women and also young children. The doses used for adults varied from 0·3 to 0·6 gms. of salvarsan and the drug was injected either intramuscularly or intravenously. The results obtained are "little short of miraculous"; granulomata disappear very rapidly, bone pains vanish in about three days, and deep tertiary ulcers usually heal in about three weeks. In three tertiary cases, with deep ulcers on the leg and necrosis and enlargement of the bone, no improvement was noticed as a result of the injections even though one of them received a second dose. In only one case was an abscess formed at the seat of injection, but this healed within a week, so that from this point of view the intramuscular mode of injection has not given such unsatisfactory results in Ceylon as in the hands of Mouzels and Nguyên-Xuan-Mai in Annam (see this *Bulletin*, p. 35).

E. H.

Cockin (R. P.). **Report on the Treatment of Twenty-two Cases of Yaws, by Salvarsan Injections, at the Yaws Hospital, St. George's, Grenada, W.I.**—*Jl. Trop Med. and Hyg.* 1912. Sept. 16. Vol. 15. No. 18. pp. 277-278.

The author has treated 22 cases of yaws by means of intramuscular (gluteal) injections of salvarsan and obtained very favourable results. In only one case was it necessary to give a second injection, all the others being cured by one dose. In two of the patients, aged respectively six and seven years, some degree of arsenical poisoning followed the injection, but both eventually recovered and were discharged 27 days after the administration of the drug. In none of the patients were any abscesses formed at the site of injection, and the pain caused was not excessive. The spirochaetes were found to disappear from the tissues within 48 hours, except in the case of the patient who required a second injection, after which the parasites disappeared.

A table is given showing the history of each patient and the result of the treatment, from which the average stay in hospital after the injection is seen to be 25 and a half days, a great improvement on the average of about three months with other modes of treatment. Moreover, two of the patients suffered from chronic yaws and had been in hospital for seventeen and eighteen months respectively, previous to the injection of salvarsan; after this treatment the first patient was discharged as cured in nineteen days and the other in seventeen days.

E. H.

Hughes (A. F.). **The Use of Salvarsan at the Yaws Hospital, Soufrière, St. Lucia (Windward Islands).**—Report to the Secretary of State for the Colonies. Received in Colonial Office, October 1, 1912.

This report contains a brief account of the results obtained in the treatment of yaws by salvarsan at the Yaws Hospital, St.

Lucia (West Indies). In all, 112 cases were treated, of which 83 have been discharged as cured after an average stay in hospital of 27 days. The remaining cases have not yet been under treatment sufficiently long. Under the old method of treatment the average duration in hospital was three months, and therefore a considerable saving is effected by the use of salvarsan. In patients over fourteen years of age 0·6 gm. of the drug was injected intramuscularly and the author advises the use of 0·8 gm. At first subcutaneous injections were employed, but were discontinued as they gave rise to necrosis at the site of injection. After treatment the patients were made to lie up for 48 hours and then compelled to bathe regularly in the sea. Meanwhile mercury was administered in fairly large doses. The effects of the treatment are marvellous, for usually after 48 hours the crusts shew signs of drying up and in some cases the patients are completely cured within a week or so. In a few cases two or three injections were necessary in order to effect a cure, but this only occurred after subcutaneous injections. No cases of recurrence have yet been noted, but sufficient time has not elapsed to express any definite opinion. A patient treated by Dr. Nicholls reported that the disease had relapsed, but in this case only 0·4 gm. of the drug had been employed. Finally, the treatment has a very beneficial effect on the minds of the patients, who become much more cheerful and happy. It is noteworthy that this mental effect is experienced even in cases of leprosy where the drug has no appreciable action on the course of the disease.

E. H.

*PROTOZOOLOGY.

General.

Todd (J. L.) & Wolbach (S. B.). **Parasitic Protozoa from the Gambia.**—*Jl. of Med. Research.* 1912. June. Vol. 26. No. 2. pp. 195-218. With 3 plates.

The Memoir forms the Second Report of the Expedition of the Liverpool School of Tropical Medicine to the Gambia, 1911. Besides observing *Trypanosoma gambiense*, various malarial parasites in man, trypanosomes in cattle and horses, and *Trypanosoma lewisi* in various rats, the authors made observations which they summarise thus:—

"The following is a list of the parasites found . . . . together with the hosts:

Trypanosome in a hornbill (*Lophoceros nasatus*)
" " dove (*Streptopella vinacea*)
" " bush fowl (*Francolinus* sp.)
" " lizard (2 species) { *Agama colonorum*, *Lygosoma* sp.
Spirochaetes in an antelope (*Hippotragus equinus*)
Piroplasmata " " " "
Leucocytozoon in a bush fowl (*Francolinus* sp.)
Halteridia in birds of 9 species:—*Vinago nudirostris, Streptopella vinacea, Turtur senegalensis, Numida meleagris, Lissotis melanogaster, Ptilopachus fuscus, Francolinus* sp., *Balearica pavonina, Neophron monachus*
A pigmented hemacytozoon in a lizard (*Agama colonorum*)
Hemogregarines in a monitor (*Varanus niloticus*)
Leucocytogregarina in a vulture (*Neophron monachus*)."

The piroplasma observed in the roan antelope seems "most nearly related to those which have been called *Theileria* in the classification of the piroplasms proposed by França . . . In the event of this being a new species, the name *Theileria hippotragi* is proposed for it." Should the leucocytogregarine from the vulture prove a new species, the name *Leucocytogregarina neophrontis* is proposed for it. Curious flagellated organisms were also found in stained preparations of heart blood of the roan antelope, which might have resulted from contamination from the alimentary tract. Trichomonads were found in a stained preparation of blood of a bush fowl, probably from the alimentary canal.

The memoir is very well illustrated by three coloured plates.

H. B. Fantham.

Plimmer (H. G.). **On the Blood-Parasites found in Animals in the Zoological Gardens during the four Years 1908-11.**—*Proc. Zool. Soc. Lond.* 1912. June. Part 2. pp. 406-419. With 7 plates.

The author has examined the blood of every mammal, bird, reptile, and batrachian that died in the Zoological Gardens, London, from 1908 to 1911, 6,430 animals in all, of which 497 harboured blood parasites.

Many of the parasites are recorded here for the first time. In other cases the host is new. None of the parasites are named, the

* Some of Dr. Fantham's contributions to this Section are held over for want of space.

author protesting (and justly) against the practice of naming as a new species every similar parasite found in a new host. The protozoal parasites include a spirochaete, trypanosomes, *Hexamitus*, *Trichomonas*, haemogregarines, plasmodia, *Haemocystidium*, *Haemoproteus* and leucocytozoa. Detailed tables showing the popular and scientific name of the hosts, their geographical situations, and the nature of the parasite constitute the bulk of the paper.

A spirochaete—resembling *S. recurrentis*—was found in the blood of a green monkey (*Cercopithecus sabaeus*).

Trypanosomes occurred in 50 mammals, 7 birds and 3 amphibia, the Fat Mouse, *Steatomys pratensis*, being a new host for a trypanosome of the nagana type. The parasitised birds harboured a trypanosome of the *T. avium* type. The birds showed anaemia and their spleens were large. A full list of hosts is given. The Batrachian trypanosomes were of the type *T. rotatorium*, Gruby.

The author notes that, in cases of ulceration of the intestine when the gut wall is permeable, flagellate parasites may leave the gut, and reach the blood stream and live, as exceptional occurrences, in the blood stream. He has found such intestinal flagellates belonging to the form *Hexamitus* in the blood of frogs and tortoises, while a species of *Trichomonas* is similarly parasitic in the blood of certain snakes. Danilewsky was the first to record the presence of intestinal flagellates in the blood. A full list of the Batrachia and Reptilia observed by Plimmer as harbouring such parasites is appended.

Haemogregarines were found in 150 reptiles of 67 different species and in 41 of these were recorded for the first time. Plimmer states that the schizonts were especially in the erythrocytes and that schizogony often occurred in the lungs of the host. A new type of haemogregarine was found in the Bengal monitor. The parasite divides the nucleus of the host cell into two parts which remain connected by a very fine strand; the schizogony (which from the figures seems to be on a large scale) occurs in the lungs. As before a full list of hosts with very brief comments on the parasites is given.

Members of the *Plasmodidae* were found in one mammal and many birds. Among the birds, *Plasmodium praecox* is noted as being deadly to the host, producing marked anaemia with considerable spleen enlargement and changes in the bone marrow. Twenty different species of birds are named as harbouring the parasite.

Haemocystidium is noted as being present in five different species of reptiles, of both the New and Old World.

Haemoproteus danilewskyi was found in 69 birds of 48 different species, in 46 of which it had not been recorded before. The birds came from Africa and America. A full list of hosts is given. The author recalls that the brothers Sergent and Aragao have stated that the principal host of *H. danilewskyi* is a fly, *Lynchia maura*.

The paper closes with a note on the occurrence of spindle shaped, unpigmented leucocytozoa in two new hosts, *Fuligula marila* and *Francolinus levaillanti*. The parasite is rare.

The earlier part of the paper deals with the parasitic worms (microfilaria) found in the blood of the animals examined (see this *Bulletin* No. 2, p. 94).

H. B. F.

PROWAZEK (S. v.). **Beiträge zur Kenntnis der Protozoen und verwandter Organismen von Sumatra (Deli).** [Protozoa and Allied Organisms from Sumatra.]—*Arch. f. Protistenkunde.* 1912. July 22. Vol. 26. No. 2. pp. 250-272. With 3 plates and 1 text-figure.

In this paper the author gives notes on herpetomonads, gut flagellates, surra and some haemogregarines, and on the development of leucocytozoa and chlamydozoa seen by him in Sumatra.

Regarding herpetomonads, Prowazek maintains the accuracy of his previous work on these parasites, nor does he admit the possibility of having dealt with mixed infections of flagellates.

Flagellates from the intestines of Europeans, Samoans, Caroline Islanders, Chamorrs, Chinese, and Malays, also from monkeys, pigeons, snakes, lizards, and frogs were examined. The commonest organisms was *Fanapepea.* Trichomonads of the usual type were seen. Autogamy is stated to be rare among them. Cysts which were not part of the life-cycle of the trichomonads were also seen.

Surra was found to be sporadic in many places in Sumatra. Subinoculations in guinea-pigs showed a diminishing, inconstant virulence. The pathological effects are noted. In the spleen of the host macrophagocytosis occurs. Here also leishmania-like involution forms, quite distinct from degeneration forms and capable of division, occur. Some indications of dimorphism, in which short broad forms are uncommon, are present. The strain of trypanosomes had somewhat smaller dimensions than usual, life measurements being 19·8 μ to 21·5 μ.

Two species of haemogregarines from *Bufo melanostictus* are recorded; the smaller, the more numerous form, is usually encysted but forms have been seen to leave the cyst. The larger parasite is usually free. *Crocodilus palustris* Cuv. and *Varanus bivittatus* Dum. and Bibr. also harboured haemogregarines.

Haemogregarina pythonis occurred in numbers in *Python reticularis.* Sexual forms and large and small schizonts were seen.

Prowazek also describes stages in the life history of a haematozoön of a fowl, which he believes to belong to the life-cycle of a Leucocytozoon. The Leucocytozoon of the Sumatran fowl varies between 44·6 μ and 66 μ, the long horns being included. Male and female forms are described. Resting forms are of two types: (1) agamonts, usually 1 to 4 in number in the host-cell, (2) club or bean-shaped forms which but slightly displace the nucleus of the host cell. True schizogony is not known. A large and a small trypanosome also occur in the Sumatran fowl, and Prowazek produces arguments which he believes indicate that the leucocytozoa and trypanosomata are parts of the life cycle of the same organism.

Toxoplasma-like forms were found in one smear of fowl's blood, and *Proteosoma*, while a pigeon harboured a small trypanosome, probably *T. avium*.

Chlamydozoa are briefly dealt with in conclusion.

[The arguments advanced by Prowazek regarding the trypanosome nature of the Leucocytozoon appear based on very artificial treatment of the organisms—treatment with saponin and staining reactions. His views regarding the relation of the blood cell and the parasite are much those of Schaudinn and do not accord with those of more modern workers; as Prowazek says, more investigation of the subject is desirable.]

H. B. F.

Carini (A.) & Rudolph (Max). **Sur Quelques Hématozoaires de Lézards au Brésil.**—*Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 592-595.

The lizards examined were captured in the State of Minas Geraes. Three Protozoa are described.

1. *Haemogregarina ameivae.*—Found in the blood of *Ameiva surinamensis.* The haemogregarine measures 11 to 13μ by 3 to 4 μ. It arranges itself usually along the long axis of the red cell, displacing the nucleus of the host cell to one pole. The nucleus of the red cell may be slightly hypertrophied and deformed.

2. *Plasmodium minasense,* an endoglobular pigmented parasite found in the blood of *Mabuia agilis.* It is round or oval and situated at one pole of the red cell. The larger parasites measure 4 to 5μ in diameter. Dividing parasites were rarely seen. A schizont with four nuclei is figured.

3. *Trypanosoma* sp.?, from the blood of *Mabuia agilis,* seen only in stained preparations. The flagellate is not figured, but is described as flat, stumpy, and often rolled up. It measures $15 \times 20\mu$. The blepharoplast is near the nucleus.

The trypanosome is like *T. perroteti* found by França in *Mabuia perroteti* in Portuguese Guinea.

H. B. F.

Flagellates of Invertebrates.

i. Chatton (E.) & Delanoë (P.). **Observations sur l'Evolution et la Propagation de *Crithidia melophagi* Flu.**—*Compt. Rend. Soc. Biol.* 1912. June 14. Vol. 72. No. 21. pp. 942-944.

ii. Cauchemez (L.). **Recherches sur la Transmission héreditaire de *Crithidia melophagi* Flu.**—*Loc. cit.* July 5. No. 24. pp. 1062-1064.

These two papers deal somewhat shortly with one of the most difficult problems of protozoology, namely the question of hereditary infection.

i. Chatton and Delanoë make a short comparison of the morphology of *C. melophagia* with the *Leptomonas* and trypanosomes of Drosophila. No stages with the blepharoplast terminally posterior (comparable to trypanoid forms of *Leptomonas*) nor forms

like the small trypanosomes of *T. drosophilae* occur in the mid-gut of *Melophagus*. On the contrary, in the hind-gut gregarine-like forms of *C. melophagia* pass through a stage with blepharoplast and nucleus posterior, corresponding to the spermoid stage of *Leptomonas*. The spermoid forms encyst and are shed in the faeces.

Regarding propagation, Chatton and Delanoë have seen no evolutionary forms of the flagellates in the ovaries or in the puparia. They also state that all freshly hatched *Melophagus* are uninfected. 23 sheep keds, hatched from isolated and washed puparia, were fed for 6 to 18 days on a sheep whose skin had been disinfected. The young keds did not become infected, while 33 out of 35 control keds showed infection. The authors doubt hereditary infection of *C. melophagia* and lay stress on contaminative infection.

The authors do not consider that *C. melophagia* has any connection with the trypanosome found in sheep's blood, thus agreeing with SWINGLE (1911).

ii. The paper by Cauchemez has much the same line of argument. Records are given of negative results obtained from 22 young *Melophagus* (fed on guinea-pigs with disinfected skin).

[Regarding the remarks of Messrs Chatton, Delanoë, and Cauchemez, it is necessary to point out that:—

(1) The specific name of the parasite is not *melophagi*, but *melophagia* (Flu). This point is explained on p. 211 of Miss PORTER's[1] paper.

(2) SWINGLE,[2] although asserting that "the only natural mode of infection is transmission through the egg," yet admits that infection may occur through the faeces by cysts, such as he actually figured in his Plate 5 (Figs. 19-21).

(3) PORTER never stated that the essential mode of propagation of the parasite is not intestinal but hereditary. On the contrary she writes (p. 213): "Infection of *Melophagus ovinus* with *C. melophagia* is either hereditary or casual. In the case of casual infection the insects ingest the post-flagellates voided with the faeces of other *Melophagus*." Again (p. 207): "I do not agree with SWINGLE that casual infection is only a remote possibility; to my mind it is a certainty." Miss PORTER also mentions a cannibalistic method of propagation.

(4) Regarding the French authors' statement that no parasite was seen in the ovaries or the puparia, it should be pointed out that rounded stages of the *C. melophagia* have been seen therein by FLU[3], SWINGLE, and PORTER. The last mentioned author states (pp. 206, 212) that the forms seen in the freshly hatched *Melophagus* are rounded and do not flagellate until the insect has sucked blood.

(5) Further, allied flagellates (e.g., *C. gerridis*, *H. muscae domesticae*) occur in the ovaries of other insect hosts, though they may not penetrate the ova.]

H. B. F.

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[1] PORTER (1910).—*Quart. Jl. Microsc. Sci.*, Vol. 55, p. 189.
[2] SWINGLE (1909).—*Jl. Infect. Diseases*, Vol. 6, p. 98.
[3] FLU (1908).—*Arch. f. Protistenk.*, Vol. 12, p. 147.

ROBERTSON (Muriel). **Notes on some Flagellate Infections found in Certain Hemiptera in Uganda.**—*Proc. Roy. Soc.* 1912. June 14. Series B. Vol. 85. No. B578. pp. 234-240.

The writer while working at Mpumu examined certain Hemiptera from the surrounding country. The hosts included *Leptoglossus membranaceus*, Fab., *Dysdercus casiatus*, *Carbula jipensis*, an unnamed reduviid bug, and an unnamed capsid bug. So far none of the species are known to attack man or other vertebrates. The flagellate parasites belong to the herpetomonad or crithidial type. Their life cycles are incomplete; hence generic names are not given. "The term herpetomonas" is used "to describe all flagellates without an undulating membrane, crithidia for forms with a membrane and with the kinetonucleus anterior to the trophonucleus."

The herpetomonas of *Leptoglossus membranaceus*, Fab. is parasitic in the gut and salivary glands of this plant-feeding bug, but has not been found in the plant. It is long and slender, with a large nucleus containing either a karyosome or chromatin granules. There is no connection "between the karyosome and the membrane" in the granular condition of the karyosome. The body of the long herpetomonads is markedly flexible. The author regards the long slender forms as derived from short thick ones. No crithidial forms were found in the bug. The salivary glands were frequently heavily infected with flagellates showing a considerable range of form. Young specimens of the bug show only gut infections. [No details are given of the condition of the flagellate in the hind gut and rectum of the bug.] Miss Robertson regards the salivary infection of *Leptoglossus* as showing "the independent development in a sucking insect of all the factors requisite for the transmission of a flagellate, parasitic in the intestine, by way of the mouth parts of the insect host."

Leptoglossus also harbours a Coccidian whose schizogony occurs in the salivary glands. Motile sickle-shaped individuals occur in the proboscis.

Dysdercus casiatus, the red cotton bug, was found to be occasionally infected in the gut with a typical herpetomonas.

Carbula jipensis shows rare and slight infection with herpetomonads also.

The reduviid bug and capsid bug contain both crithidial and herpetomonad forms. Miss Robertson believes that these are two forms of one and the same organism, the crithidial forms being transitory youth forms, the long herpetomonads adult forms, but admits that there is very much to say in favour of the opposite view and so leaves the matter an open question.

The capsid bug "is found in or near forest and is of the same light brown colour as the fallen leaves on which it runs. Its food is not known and it is apparently not a very common bug." The reduviid bug is red and black; it "is a common species and feeds on small bugs and on other insects."

The paper is illustrated by 32 text-figures.

H. B. F.

HINDLE (E.) & LEWIS (R. C.). **Note on "*Crithidia*" *cleti* n.sp., Parasitic in the Alimentary Canal of *Cletus varius* Dall.** —*Parasitology.* 1912. June. Vol. 5. No. 2. pp. 109-113. With 17 text-figures.

HINDLE (E.). **What is the Genus *Leptomonas*, Kent?**—*Ibid.* pp. 128-134.

The organism referred to as "*Crithidia*" *cleti* by the authors has been observed in stained specimens only of preparations of the gut of *Cletus varius* Dall., a bug from the Transvaal. The preflagellate forms are somewhat irregular, 7 μ long by 3·5 μ broad. The trophic nucleus is large, horseshoe-shaped and deep staining. The structure termed the end bead of the organism was found dividing on one occasion in addition to the nuclei. The flagellates were numerous, often in process of multiplication. The nucleus is usually situated midway in the cytoplasm and may show a central karyosome or more often a series of granules. The position of the kinetic nucleus varies, but it is usually near to and anterior to the nucleus. The total dimensions of the typical flagellate are 25 μ long by 2 μ broad, total length of flagellum 16 μ, length of free flagellum 4 μ. Division is of the usual type commencing at the anterior end. The formation of the post-flagellate stage has only been observed in a single specimen, which may be a degenerating form. The cysts when fully formed are usually spherical, about 3 μ in diameter.

The authors express doubt as to what name should be given to the parasite, which undoubtedly comes within the genus *Crithidia* of PATTON, and give as reason for this course views published by one of them in a subsequent paper (see below):—

[There is no reason really in this lack of definite position, for in the consideration of the genus *Leptomonas* of Kent the genus *Crithidia* (as emended by PATTON) is not concerned. The only other genus concerned is *Herpetomonas*. The authors therefore need not have hesitated to call the parasite *Crithidia cleti*, more especially as it occurs in a bug that feeds only on the juices of plants.]

The second paper not only asks a question, but also leaves it unanswered. It consists of an historical résumé similar to that published by many previous workers, but in addition invokes the "Law of priority" in the "International Code of Zoological Nomenclature" to confute the work of BÜTSCHLI, who used the generic name *Herpetomonas* in preference to *Leptomonas*, though KENT happened to describe *Leptomonas* two pages before *Herpetomonas* in his "Manual of the Infusoria."

Hindle desires a new study of the type, *Leptomonas bütschli*, from *Trilobus gracilis*.

[At the time BÜTSCHLI wrote such a rule was not emphasised, and BÜTSCHLI can hardly be blamed for using the generic name that was best defined. Further, zoologists are not of one mind on the strict applicability of such a rule, a circular calling for

expressions of opinion on the subject having been sent out as recently as last June. The argument of the possibility of a crithidial stage existing in the type species of *Leptomonas*, as described by KENT when founding the genus, is at present speculative—there is no definite evidence.]

H. B. F.

CARDAMATIS (J. P.). **Des Flagellaires dans la Mouche Domestique. Identité de la Leptomonade et de l'Herpétomonade. Nouveau Mode de Multiplication de l'Herpétomonade de la** *Musca domestica.—Centralbl. f. Bakt.* 1. Abt. Orig. 1912. July 3. Vol. 65. No. 1-3. pp. 66-76. With 4 plates.

The author commences with a brief review of some of the literature relating to members of the genera *Trypanosoma*, *Herpetomonas*, and *Crithidia*. He points out the polymorphism existing among members of the two latter genera, and certain similarities between flagellates with a trypanosome facies found in some flies and the *Leptomonas* of CHATTON and ALILAIRE, who found parasites of forms intermediate between the two. He also states that *Trypanosoma granulosum*, parasitic in eels, becomes a young leptomonad form in the leech *Hemiclepsis marginata*, but on the 14th day after deglutition these forms are reconverted into small trypanosomes. Hence he concludes that the relation between herpetomonads and trypanosomes is established.

Reviewing the question as to the number of flagella present, the author agrees with many other workers that primitively *Crithidia* and *Herpetomonas* are uniflagellate. He has seen forms with two rhizoplasts in cultures, but sometimes the two united later. With WENYON he is in accordance as to a thin membrane sometimes connecting the two flagella, and that sometimes a new rhizoplast appears to grow concurrently with a new flagellum. The latter case, he considers, merely shows the great tendency of the organism to multiply intensively by division, and that it is superfluous to make a distinction between leptomonads and herpetomonads based on the single or double character of the flagellum. If this distinction be suppressed, the monoflagellate is the young form and the biflagellate condition marks not only the period of most active multiplication but also the end of the flagellate stage of existence.

A detailed account of the behaviour of cultures of the flagellates of the house fly is given. The cultures seem to pass through the preflagellate to flagellate and post-flagellate stages in about 8 days. On the 10th day many young forms appear due to active division during the postflagellate stage (1) by schizogony; (2) by thickening of the protoplasm without apparent schizogony; (3) by protoplasmic prolongations; (4) by gemmation; (5) by bipartition of young parasites.

On the 20th day of the culture remarkable forms are found, some large and spherical with a large nucleus, which Cardamatis terms females, others smaller which he terms males.

[Whether the sequence of events described occurs also in the house fly is a matter of some doubt, and it would seem that much more value is to be attached to stages actually observed in the

intestine of the fly than to forms obtained by culture in broth or serum, which naturally can be regarded only as an artificial environment.]

H. B. F.

FANTHAM (H. B.). **Note on the Occurrence and Distribution of** *Herpetomonas pediculi.—Ann. Trop. Med. and Parasit.* 1912. Oct. 18. Vol. 6. No. 3. B. pp. 403-404.

The author refers to his previous paper (*Proc. Roy. Soc.*, 1912, B. Vol. 84, pp. 505-517) on *Herpetomonas pediculi*, where this parasite was first recorded from the gut of the human body-louse in England, and where its life cycle was described in detail. The flagellate is a natural parasite of the louse, as was shown by breeding and feeding experiments.

The author has now found the Herpetomonas in the digestive tract of head lice in England, and records its occurrence in body-lice in Bombay (seen by Capt. MACKIE) and in Tunis (seen by Dr. BLAIZOT). Its distribution, therefore, is wider than was at first suspected.

H. B. F.

RODHAIN (J.), PONS (C.), VANDENBRANDEN (J.) & BEQUAERT (J.). *Leptomonas pangoniae*, **Parasite de** *Pangonia infusca.—Bull. Soc. Path. Exot.* 1912. Oct. Vol. 5. No. 8. pp. 604-608.

The flagellate occurs in the intestinal tract of the Tabanid fly, *Pangonia infusca*, found in the Congo State. The flies occur at the end of the wet season along the beds of the drying rivers. The females feed on the blood of man or of mammals. The males examined were not parasitised, but nearly 40 per cent. of the females contained flagellates; usually parasites occur only in those females which have had at least one meal of blood.

The flagellates are most abundant in the posterior part of the intestine, in the blackish liquid contents. In the terminal part of the intestine there are fixed cystic forms. The cysts contain nucleus and blepharoplast. No preflagellate stages were seen in the anterior part of the intestine, and no parasites occurred in the intrathoracic part of the gut. *Leptomonas pangoniae* have been inoculated into a sheep, a rat, and a mouse, but no parasites were found in the blood of these mammals. They were also mixed with goat's blood and *Glossina morsitans* were fed on the mixture. The intestines of the flies examined 24 to 72 hours after showed no living parasites. Defibrinated goat's blood also rapidly killed the flagellates.

The authors consider that *Leptomonas pangoniae* is a parasite peculiar to the tabanid host. It is difficult to test this experimentally, as flies kept in captivity regularly die after 3 days.

[It is to be regretted that the paper is not illustrated by text figures. These are especially desirable where forms stated to be intermediate between two genera are mentioned briefly in three lines.]

H. B. F.

Haemogregarines.

Leger (André). i. **Leucocytozoaire de l'Hyéne tachetée du Haut-Sénégal et Niger.**—*Compt. Rend. Soc. Biol.* 1912. July 5. Vol. 72. No. 24. pp. 1060-1062.

ii. **Présence de Deux Leucocytozoaires Morphologiquement Distincts dans le Sang du Chien, à Bamako (Haut-Sénégal et Niger).**—*Ibid.* Oct. 25. Vol. 73. No. 29. p. 376.

i. A leucocytozoon was observed by the author in the blood of one *Hyena crocuta* out of six examined. The animal exhibited no sign of illness during two months of observation. The parasitised leucocytes always averaged 1 to 2 per cent. The organism was seen in both fresh and stained preparations. In the latter the adult form is clearly ovoid; its extremities are rounded, but one extremity is more elongated than the other. The average size is 8 μ by 6 μ. The parasite is usually surrounded by a capsule. The nucleus, about 3μ in diameter, occupies usually the broader extremity of the ovoid body. The host cell appears to be a mononuclear leucocyte, but the nucleus of the host cell is distorted by the parasite and may appear like that of a polymorphonuclear. Free forms were never seen in the blood. Up to the present attempts at inoculation of the parasite from hyaena to hyaena and from hyaena to dog have failed. The parasite differs in size from *H. canis* and *H. canis adusti*, and is nearer to *H. rotundata* recorded by Patton from *Canis aureus*. However, A. Leger considers the parasite of the hyaena worthy of specific rank and names it *Haemogregarina chattoni*.

ii. The author refers to the above note. He has now found this leucocytogregarine (*H. chattoni*) in the mononuclear leucocytes of 2 dogs out of 114 examined around Bamako. No free forms of the parasite have yet been seen.

H. chattoni differs from *H. canis* in size and form, being smaller, shorter, and more stumpy. *H. canis* was found in 4 dogs out of the 114 examined.

H. chattoni and *H. canis* have not yet been found to occur together in the same dog.

H. B. F.

Sangiorgi (Giuseppe). *Leucocytogregarina musculi.*—*Centralbl. f. Bakt.* 1. Abt., Orig. 1912. Sept. 19. Vol. 66. No. 2-4. pp. 287-293. With 1 plate.

The parasite was found by the author in white mice, apparently in Turin. It is the same as that discovered by Dr. Annie Porter in white mice in London in 1908.

Sangiorgi found the parasites to be numerous in the lungs, fewer in the peripheral blood, bone-marrow and liver, and rare in the kidney and the spleen. The parasites were often free in the blood-plasma, only a few occurring in the mononuclear leucocytes. They measure 9·4 μ to 14·2μ by 4·7 μ to 6·3 μ. The nucleus is generally eccentric. A cytocyst may be present. In the lungs somewhat thinner forms are seen, 7 μ to 8·5 μ by 3·1 μ to 5 μ.

Various multiplicative stages were observed in the lungs in two heavily infected mice. In poorly infected hosts these stages are not found. Schizogony occurs in the lungs, sometimes within a leucocyte, sometimes free in the plasma. The author compares the distribution and life history of the parasite in his mice with those found by PORTER in considerable detail. The latter found schizogony in the bone-marrow.

The louse, *Haematopinus spinulosus*, acts as a mechanical carrier of the parasite from mouse to mouse.

H. B. F.

MICROSPORIDIA.

FANTHAM (H. B.) & PORTER (Annie). (i) **Microsporidiosis, a Protozoal Disease of Bees due to** *Nosema apis*, **and popularly known as Isle of Wight Disease.**—(ii) **The Morphology and Life History of** *Nosema apis* **and the Significance of its Various Stages in the so-called "Isle of Wight" Disease in Bees (Microsporidiosis).**—(iii) **The Dissemination of** *Nosema apis.*—*Ann. Trop. Med. and Parasit.* 1912. July 31. Vol. 6. No. 2. pp. 145-214. With 3 plates.

The cause of "Isle of Wight" disease in bees was discovered by the authors in 1906 to be a minute Microsporidian parasite, *Nosema apis*. The disease is now known to be more widely distributed and is termed microsporidiosis.

Nosema apis is, chiefly, a parasite of the alimentary tract of the bee, but can invade the body cavity or haemocoel and multiply therein. Spores of the parasite, swallowed with food or drink by the bee, give rise each to an amoeboid parasite, the planont, which parasitises either an epithelial cell of the gut or else reaches the haemocoel. In either case it becomes rounded, grows and feeds for a time, and then commences to multiply.

The process of multiplication is termed merogony and the dividing form is called the meront. Daughter meronts are formed by binary fission, producing clusters or chains. Each daughter meront is ultimately uninucleate. The meront stage of the parasite is often deadly to the host, in which case the parasite cannot attain its full development, the spore. Merogony causes derangement of the bees' digestive processes.

The second or propagative stage of the *Nosema* life-cycle, known as sporogony, serves for the transference of the parasite to new hosts. The full-grown meront becomes the pansporoblast or sporont, which undergoes complicated nuclear changes whereby five nuclei are ultimately produced. The sporoblast forms two vacules, an anterior one, called the polar capsule, and a posterior vacuole in which the polar filament is coiled. The secretion of the sporocyst converts the sporoblast into the spore. The great power of merogony compensates for the formation of but one spore from the pansporoblast.

The symptoms of microsporidiosis vary. Inability to fly, crawling, dislocation of the wings, abdominal distension, and "dry dysentery" followed by early death may be noted. Warm,

bright weather favours the bee, wet or damp aids the parasite. Bees weak after hibernation rapidly succumb.

Nosema apis has been proved fatal by feeding hive bees, mason bees, and wasps on honey containing *Nosema* spores; by smearing infected excrement on healthy bees and allowing them to clean themselves; by uniting healthy and infected bees; by placing healthy bees in cases in which infected stock had travelled.

In nature, the method of infection is contaminative. Hives comb, honey and pollen from comb have all been found to contain *Nosema* spores. Bees' drinking places infected with *Nosema* spores have been observed. Flowers, water from foliage, and dew from low plants near infected hives all have contained spores, Wind can act as a distributor of *Nosema* spores, also ants and wax-moths. Some bees can adapt themselves somewhat to the parasite, which forms many spores within them. Such parasite carriers act as reservoirs of disease.

In the treatment of the disease preventive measures seem of most value. The only certain destructive agent for *Nosema* spores is fire. All dead bees should be burned. Old comb and hives untreated by a painter's lamp after disease are to be avoided. Weak stocks should not be united. Great care should be exercised in importing bees whether from other places in the British Isles or abroad. Liming the soil around each hive is of service. Provision of abundant honey and pure water supply, together with scrupulous cleanliness of the hive and its surroundings, are great aids in the prevention of microsporidiosis.

[It is to be regretted that, so far, no Microsporidia pathogenic to Glossina have been found. If such occur, they might be utilised in exterminating Glossina.]

H. B. F.

Cardamatis (J. P.). **De Quelques Microsporidies chez la Mouche Domestique.**—*Centralbl. f. Bakt.* 1. Abt. Orig. 1912. July 3. Vol. 65. No. 1-3. pp. 77-79. 1 plate.

The author has found stages of some Microsporidian in the intestine of flies allowed to feed on matter from an oriental sore (*Bouton d'orient*). Some stages of the parasite resemble piroplasms, others Leishman-Donovan bodies. Some are extremely small, others large. A nucleus is, as a rule, only demonstrable after prolonged staining with Giemsa. Some parasites multiply by budding. Others become annular, showing a nucleus and blepharoplast of different staining reaction. The annular forms may become elongate. The author states that some of the parasites resemble stages of *Schizotrypanum* or of *Octosporea muscae domesticae*. Whether the parasites thus briefly described are connected with the life history of the herpetomonad of the fly or with the Microsporidia described by various writers, the author says he cannot decide, but he emphasises the fact that the host flies had fed on matter from ulcers of oriental sore.

H. B. F.

Classification of Flagellates.

Alexeieff (A.). **Sur Quelques Noms de Genres des Flagellés qui doivent disparaître de la Nomenclature pour Cause de Synonymie ou pour Toute Autre Raison. Diagnoses de Quelques Genres récemment étudiés.**—*Zool. Anzeiger.* 1912. June 25. Vol. 39. No. 23-24. pp. 674-680. With 2 figures.

The author considers that:

Leishmania, Ross 1903, should be united with *Herpetomonas;*

Leptomonas, Kent 1880, is synonymous with *Herpetomonas;*

Cercoplasma, Roubaud, 1911, is synonymous with *Herpetomonas;*

Endotrypanum, Mesnil and Brimont, 1908, is insufficiently characterised, and is probably a *Trypanosoma;*

Schizotrypanum, Chagas, should be incorporated in the genus *Trypanosoma;*

Copromonas, Dobell, 1908, is synonymous with *Scytomonas,* Stein.;

Prowazekia, Hartmann and Chagas, is synonymous with *Bodo,* Ehbg.;

Trypanoplasma, Laveran and Mesnil, is synonymous with *Cryptobia,* Leidy.

Diagnoses of several genera are given.

H. B. F.

Alexeieff (A.). **Sur la Revision du Genre *Bodo* Ehrbg. (Réponse à M. le Professeur M. Hartmann).**—*Arch. f. Protistenkunde.* 1912. Sept. 6. Vol. 26. No. 3. pp. 413-419. 1 text-figure.

The author discusses the synonymy of the genus *Bodo* (Ehrenberg) and *Prowazekia* (Hartmann and Chagas).

He points out that in a free living *Bodo* described by Prowazek in 1903 there is a kinetic nucleus present, though Prowazek termed it the "*Geisselsäckchen.*" According to Stiles the type species of *Bodo* is probably *B. saltans.*

Alexeieff proposes the name *Prowazekella* (n.g.) *lacertae* for "*Bodo*" *lacertae.* He also discusses forms between *Bodo* and *Cryptobia* (*Trypanoplasma*), genera which possess kinetic nuclei.

The author gives some text figures of *Bodo caudatus.* For further details those interested should consult the original paper.

H. B. F.

Unclassed.

Sinton (J. A.). **Some Observations on the Morphology and Biology of *Prowazekia urinaria* (*Bodo urinarius,* Hassall).**—*Ann. Trop Med. and Parasit.* 1912. July 31. Vol. 6. No. 2. pp. 245-268. With 2 plates.

The author discusses the genera *Prowazekia* and *Bodo* and the separation and creation of the former genus from the latter. *Prowazekia* was founded by Hartmann and Chagas in 1910 for Bodo-like flagellates possessing a kinetic nucleus—the genus *Bodo* not possessing such a structure.

The earliest reference to the occurrence of Bodo-like flagellates in the urine was that of Hassall (1859), who found them in fifty

samples of urine from a number of different patients. HASSALL named the parasite *Bodo urinarius*, and gave a very good description of it. The parasite was again described or referred to by SALISBURY (1868), KUNSTLER (1883), BLANCHARD (1885) and BRAUN (1895) under various names.

The flagellates were found by Sinton in March 1912 in the deposit, after centrifugation, of a 24-hour old specimen of urine from a Mexican sailor in the Royal Southern Hospital in Liverpool. The patient was suffering from malignant tertian malaria and had a history of an attack of blackwater fever a few days prior to admission. The flagellate was subsequently seen in the deposit of a six-hour old specimen of urine from the same patient. The reactions of the urine were alkaline and neutral respectively. Neither of the specimens was taken with aseptic precautions.

When specimens of urine were taken with aseptic precautions the flagellates were not seen, and it was found that a temperature of 37° C. rapidly killed the cultures. The author consequently inclines to the view that the flagellate was probably not an inhabitant of the urinary tract but was an accidental contamination. The author used the method of SELLARDS (1911) for the isolation of pure cultures.

The morphology of the different forms is described and figured in detail. In *Prowazekia urinaria* there are two flagella (anterior and lateral) and two nuclei. The lateral flagellum is free, but lies along the body on the "flagellar side." In cultures three types of the parasite were found. All three were found to develop in a hanging-drop culture from a single flagellate. Morphological details are given.

The movements of progression, methods of multiplication, and the movements occurring during division are described in detail. The differences between division rosettes (in which the anterior flagella point outwards) and aggregation rosettes (in which the flagella may point in any direction, while the parasites are merely entangled) are described and illustrated. The processes of encystment and emergence of the flagellate therefrom were studied. The optimum temperature for growth of the parasites is 20° C., but growth occurs up to 30° C.

The paper is well illustrated by two coloured plates and twenty-two text-figures.

H. B. F.

CARINI (A.). **Sur un Nouvel Hématozoaire du Pigeon.**—*Compt. Rend. Soc. Biol.* 1912. Oct. 25. Vol. 73. No. 29. pp. 396-398.

While examining the blood of a pigeon which had died from an experimental infection of canine *Toxoplasma*, the author found numerous parasites in the red blood cells which he considers to be new. The red blood corpuscles were neither decolourised nor hypertrophied by the parasite, though when the latter was large the nucleus of the host cell might be displaced towards the edge.

According to its stage of development the Haemosporidian, which contains pigment granules, exhibits the following forms:—small rounded forms; intermediate, round or oval forms; halter-shaped forms; forms with pseudopodia.

The parasites with pseudopodia are very characteristic and according to Carini separate the parasite from *Haemoproteus*. Halter-shaped forms are rare and sexual differentiation is not so clear as in *Halteridium*. Multiplicative forms have not been found in smears of the spleen, liver, kidney and bone-marrow, though numerous *Toxoplasma* exhibiting binary and multiple fissions were seen in the same preparations. Up to the present, the parasite has only been seen in one pigeon.

Carini proposes for this new pigmented avian haematozoön the name *Plasmodium columbae*, though he adopts the generic name with some reserve.

The paper is illustrated by five text-figures.

H. B. F.

PATTON (W. S.). *Spirochaeta ctenocephali*, **sp. nov., parasitic in the Alimentary Tract of the Indian Dog Flea,** *Ctenocephalus felis*. —*Ann. Trop. Med. and Parasit.* 1912. Oct. 18. Vol. 6. No. 3. B. pp. 357-359.

A new spirochaete has been found by the author in two larvae and one adult of *Ctenocephalus felis*. The larvae were bred from fleas living on two cats in the laboratory at Madras, while the adult fleas was taken from a dog in Madras.

The spirochaete is rare, for 1,500 larvae and 500 adult fleas were dissected, and the percentage of infection was only 0·15. The parasite was examined both fresh and stained. Transverse division was seen, and longitudinal division was strongly suspected. Long forms of the spirochaete measured 20 μ and short forms 4 to 6 μ in length. *Spirochaeta ctenocephali*, as the author names it, is a natural parasite of the gut of *Ctenocephalus felis*, the larva of which lives on the excreta of the adult.

H. B. F.

PATELLA (Vincenzo). **Sulla Natura Protozoaria dei Corpi di Kurloff.** [On the Protozoal Nature of Kurloff's Bodies.]—*Riforma Medica.* 1912. June 22. Vol. 28. No. 25. pp. 675-676.

The author believes that the Kurloff bodies are organic and belong to the Protozoa. He states that FOA first suspected the parasitic nature of these bodies and that he himself in 1907 first demonstrated it. He summarises the views of FERRATA, CESARIS-DEMEL, SCHILLING, PAPPENHEIM, LANFRANCHI and E. H. ROSS. He agrees with the conclusions of E. H. ROSS.

H. B. F.

BERIBERI.

Laboratory and Experimental.

Funk (Casimir). **The Etiology of the Deficiency Diseases.**—*Jl. of State Med.* 1912. June. Vol. 20. No. 6. pp. 341-366.

In this important paper the author groups together several conditions termed deficiency diseases. These are beriberi, polyneuritis of birds, epidemic dropsy, scurvy, experimental scurvy in animals, infantile scurvy, ship beriberi, and pellagra. Diseases which were formerly considered either as intoxications by food or as infectious have now, after twenty years of experimental work, been shown to be caused by a deficiency in some essential substance in the food.

All these diseases present general characters—(1) Cachexia, with enormous loss of weight, and (2) marked nervous symptoms, generally of the nature of peripheral neuritis. Funk states that all (except pellagra) can be prevented and cured by the addition of certain preventive substances, the deficiency substances, which are of the nature of organic bases, and called by him vitamines. He divides these diseases into two groups, the beriberi and the scurvy groups.

The beriberi group includes beriberi, polyneuritis in birds, and epidemic dropsy. The results of the early experiments of Braddon, Fraser and Stanton, Eijkman, and Schaumann are given. During the last two years there have been many papers dealing with the isolation of the protective substances from food stuffs, rice polishings, katjang-idjoe beans, yeast, etc. The author thus summarises the knowledge, up to 1911, of the chemical nature of the protective substance in rice polishings: (1) The substance is soluble in water, alcohol, and acidulated alcohol, and is dialysable; (2) it is destroyed by heating to 130° C. and is not a salt or protein. He set to work to find what the active principle of this substance really was; after many experiments he showed that it contained neither phosphorus, proteins nor carbohydrates, and that it was of a basic nature. Finally a crystalline substance was obtained which had active curative powers. This he calls beriberi vitamine ($C_{17}H_2N_2O_7$).

Schaumann's idea was that the curative agent acts only as an "activator" and that besides this a substance of a phosphatide nature is necessary. The author states that this can only be proved by further experiments, and proposes to feed birds on polished rice with the addition of vitamine. He states that a curative vitamine can also be extracted by alcohol from milk, ox brain, and lime juice.

Dealing with beriberi he writes: "Judging from the manifest nervous symptoms, the fatty degeneration in the nerve cells, and the chemical changes, I am inclined to think that vitamine is necessary for the metabolism of the nervous tissue." The lack of vitamine forces the animal to get this substance from its own tissues, the result being an enormous loss of weight, after which the available stock begins to be scarce. There is a consequent breaking down of the nervous tissues, with the result that nervous symptoms, such as are seen in beriberi, manifest themselves.

He classes ship beriberi with the scurvy group, but all forms are intimately connected. Different food stuffs which are known to prevent beriberi and polyneuritis, such as yeast, oats and barley (unhusked), are unable to prevent scurvy. On the other hand grains develop the scurvy vitamine during germination, and this suggests that scurvy vitamine can be formed by enzyme action from beriberi vitamine. The anti-scorbutic substance must be supplied as such by plants. In ships the food gets poor in scurvy vitamine more quickly than in beriberi vitamine, the result being an outbreak of scurvy or ship beriberi. Finally, milk provides all the constituents necessary for the growing organism and must contain all kinds of vitamines; but these are very unstable, being easily destroyed by heat.

P. W. Bassett-Smith.

Schaumann (H.). **Über die Darstellung und Wirkungsweise einer der in der Reiskleie enthaltenen, gegen experimentelle Polyneuritis wirksamen Substanzen. Vorläufige Mitteilung.** [The Production and Mode of Action of a Substance contained in Rice-Bran, effective in Experimental Polyneuritis. (Preliminary Report.)]—*Arch. f. Schiffs- u. Trop. Hyg.* 1912. June. Vol. 16. No. 11. pp. 349-361.

Schaumann describes very fully his further experiments relating to the appearance, production, and properties of the very active substance found in rice-bran, which he calls the activator. He isolated this active principle in small quantities by methods similar in many ways to those employed by Funk, and obtained much the same result with it. He found that the crystalline body, which produces such a marked effect upon the paralysis of pigeons suffering from experimental polyneuritis, was active when given by the digestive tract, as well as by injection. His work also showed that with this (in a certain sense) curative substance is found another very poisonous ingredient, probably choline, and that there is not more than 0·5 gram of the active curative substance in a kilo of rice-bran; Funk estimates it at double that amount, but probably the proportion is not constant. The author goes on to point out that the end product, the nitrogenous base, cannot be looked upon as the only curative substance, the beneficial effect being produced by the collective effect of several substances; that is to say, the pure base can only play an indirect or mediate rôle. To support this view, he shows that in the case of a bird affected with this disease the administration of the pure base may remove the paralytic symptoms, but the bird continues to get weaker and thinner. On the other hand if the extract of the bran be given, even if the bird is fed on polished rice only, it will recover from the paralysis and gain weight. He considers that the minute dose of the extract or pure base that is found effective cannot be looked upon as an actual supply of food stuff, and shows that in cases so treated nerve degenerations are often marked, and that the degree of paralysis gives no measure of the amount of nerve degeneration. The very rapid recovery from paralysis, which occurs a few hours after the active substance has been given, shows that the paralysis cannot be due to structural

pathological changes in the nerves. For the present he thinks we must accept the view that we have to deal with a body possessing a ferment-like reaction, acting as a catalyser.

The author intends to make further researches on the presence and effect of phosphates in the extracts. The active crystalline basic substance is found only in the pericarp of the rice grain together with the greater part of the phosphorus; it is possible that the activator may be of the utmost physiological importance for utilising this large amount of phosphorus in the normal germination of the grain. According to the researches of STÂNEK, betain, a nitrogenous base derived from trimethylamin, is directly accumulated in the vegetative organs which are physiologically most active; from this he concludes that this substance is not a waste substance, but is of importance in the metabolism of the plant tissue. The nitrogenous base isolated from rice bran is to all appearance similar to betain; there exist moreover between the metabolism of nitrogen and phosphorus most intimate relations.

P. W. B.-S.

EDIE (E. S.), EVANS (W. H.), MOORE (B.), SIMPSON (G. C.), & WEBSTER (A.). **The Anti-Neuritic Bases of Vegetable Origin in Relationship to Beri-Beri, with a Method of Isolation of Torulin, the Anti-Neuritic Base of Yeast.**—*Ann. Trop. Med. and Parasit.* 1912. July 31. Vol. 6. No. 2. pp. 235-243.

The authors give a summary of some of the numerous papers which have been published since 1910, when they last wrote. SCHAUMANN had already suggested that other diseases might have a similar etiology to beriberi. FRASER and STANTON demonstrated that the active antineuritic substance of rice meal is soluble in water and alcohol; is stable in acid, but unstable in alkaline solutions; is thermolabile, is not a phytin or fat, and probably not a protein nor containing phosphorus; but that the phosphorus content of rice was an indicator of its safety as an article of food, which should contain at least 0·4 per cent. of P_2O_5. EIJKMAN had in 1897 demonstrated that beriberi could be prevented and cured by the use of hand milled rice. He isolated the active substances and strongly opposes SCHAUMANN's theory (1910) that the active principle is a phosphorus-containing compound. SHIGA and KUSAMA confirmed much of FRASER, STANTON, and EIJKMAN's work, disproving the bacterial and toxic theories. KILBOURNE showed the importance of the potassium content of rice meal. CHAMBERLAIN and VEDDER showed that the active curative substance from rice meal was able to dialyse through parchment. A daily dose of these extracts, containing 0·16 mgm. of P_2O_5 and 4·06 mgm. of nitrogen, cured fowls that were severely lamed, in a few days. FUNK has isolated from rice meal a crystalline nitrate of an organic base, which is extremely active in reviving pigeons that have contracted neuritis from feeding on polished rice. The formula he gives for this substance is $C_{17}H_{19}O_4N$ (HNO_3) (*v. supra*).

The authors found that when rice meal is heated to 120° C. (denaturisation) nearly twice as much of its phosphorus goes into solution in water as is the case with unheated rice; and of this soluble phosphorus only two-thirds dialyses, whereas five-sixths of the soluble phosphorus of unheated rice is able to do so.

They found, moreover, that after dried yeast was heated to 120° C. more than twice as much of the phosphorus appeared as phosphatide phosphorus than did before being heated. Alcoholic extracts of rice meal were found to be active in protecting birds from the onset of neuritis and in curing them, but concentrating the extracts on a water bath rendered these inactive. FUNK's method of extraction was tried on the original extract of the meal. In spite of continued treatment with the extract, the birds died in a few days. An attempt to extract the active substance from Katjang beans proved unsuccessful.

They next investigated the anti-neuritic powers of extracts of yeast. The method adopted for the isolation of the active principle is given in detail. Doses from ·003 to ·006 gm. gave most favourable results with experimental birds. The formula of the crystalline product they give as $N(CH_3)_3\ C_4H_7O_2\ (HNO_3)$ and for this they propose the name of "Torulin," the active principle of the yeast.

P. W. B.-S.

SHIGA (K.). **Experimentalle Studien über die Kakke (=Beriberi).** (2. Mitteilung). [Experimental Studies of Beriberi.]—*Centralbl. f. Bakt.* 1. Abt. Referate. 1912. Aug. 22. Vol. 54. Beilage. pp. 156*-170*.

The author, with KUSAMA, reported last year as the result of their investigations that the paralysis experimentally produced in animals was identical with, or very nearly related to beriberi in man; and that both were caused through the deficiency of certain substances in the food. In hens and pigeons atrophy, anasarca, and degeneration of the nerves were demonstrated, and in two apes hypertrophy and dilation of the heart were observed, a condition similar to that found in man. According to their experiments the deficiency substance in the food had nothing to do with phosphorus combinations.

Shiga accepts NOCHT's and SCHAUMANN's views that beriberi is caused by a partial underfeeding, but he believes that a want of balance between the food supply and the work done may bring about the same result (*e.g.*, as in the physiological strain of pregnancy, during which the disease often appears); and that individual predisposition, sex, age, and the time of the year play an important part. His experiments showed that the motor paralysis of pigeons fed on polished rice appeared in three or four weeks, that death followed in two or three days, and that pigeons which did not show any paralysis died later from inanition. In his experiments with fowls paralytic symptoms, associated with a great loss of weight, came on in eight weeks. From further observations on these birds, which he fed intermittently with polished and unpolished rice, and treated with injections of "pericarpin" (bran extract), he concluded that the general

atrophy was in no way connected with the paralysis, nor necessarily preceded it. When the alcoholic extract was given at the first appearance of paralysis, this sign would rapidly pass off, as if the nerves had regained their normal (tonic) condition from a simple atonic state; but if the paralysis had reached a high grade and histological changes had probably taken place, repeated injections would be required for a cure. His experiments also showed that after injections of the alcoholic extract, although the paralysis quickly disappeared, recovery of the lost weight did not follow, and that paralysis was frequently present when the muscles were in good condition. The extract administered by the mouth did not act so rapidly as when given by injection.

The author found that nucleic acid and lecithin had no curative effect on the paralysis, and that alcoholic extracts of green Manchurian beans were more effective than those made from red beans (*Phaseolus radiatus*); barley mixed with rice had a preventive action. The following conclusions are given:—

1. Beriberi appears where there is a deficiency of a certain substance in the food, and may be indirectly brought about by all conditions which produce a loss of nutrition.
2. Individual predisposition plays a very important role.
3. The preventive substance in rice-brain is soluble in alcohol, and can be separated from the other ingredients, which have no curative value.
3. The paralysis in fowls has no direct relationship in time or amount to the atrophy.
5. Pigeons fed on equal parts of polished rice and barley were not affected; if the quantity of barley was reduced, paralysis generally appeared.

P. W. B.-S.

FUNK (Casimir). i. **The Preparation from Yeast and certain Foodstuffs of the Substance the Deficiency of which in Diet occasions Polyneuritis in Birds.**—*Jl. of Physiol.* 1912. Aug. Vol. 45. Nos. 1-2. pp. 75-81. ii. **The Substance from Yeast and certain Foodstuffs which prevents Polyneuritis (Beri-Beri).**—*Brit. Med. Jl.* 1912. Sept. 28. p. 787.

The author, in continuation of his previous work, gives further details relating to the preparation of the curative substance which he terms vitamine, minute quantities of which are essential in the diet of birds, man, and some animals. Working with yeast he obtained after much trouble a small quantity of the pure substance. Many cures were effected in pigeons with doses of 0·02-0·04 grm., and he considers it to be the sole curative agent. He corrects a previous statement that this substance was isolated in the form of a nitrate; it must be regarded as a base, probably belonging to the pyramidine group, and has the following formula—

$$\begin{matrix} NH \\ CO \\ NH \end{matrix} \Big\rangle C_{16}H_{18}O_6 \text{ Vitamine.}$$

From 51 kg. of rice polishings a substance named allantoin was isolated; it was entirely different from the curative substance,

but seemed to prolong the lives of seven pigeons suffering from polyneuritis.

The chemical properties of the curative substance suggest that it forms a constituent of a nucleic acid.

P. W. B.-S.

Clinical and Epidemiological.

Andrews (V. L.). **Infantile Beriberi.**—*Philippine Jl. of Science,* Sec. B. [*Philippine Jl. of Trop. Med.*] 1912. April. Vol. 7. No. 2. pp. 67-89. With 3 plates.

The author states that, though there has been so much written about beriberi in adults, it is only in Japan and the Philippines that it has been noticed in infants. Hirota from clinical observations (1888-1897) concluded that there was an infantile form of the disease, and this was recognised in the Philippines under the name of "taon." Deaths from this disease were so frequently reported that the Health Bureau in 1909 took steps to confirm the diagnosis. In 1910 the post-mortem reports of children under one year showed evidence of infantile beriberi in 56 per cent. Clinically the children, usually about two months old, suffered from oedema, dyspepsia, and cyanosis, but often, when apparently well, a child would be seized with a fit of crying, evidently on account of great pain, and in a few hours would be dead.

Further observations showed that all the children affected were breast fed, that the mother had nearly always symptoms of beriberi, and that her diet was frequently defective. The milk was very poor, but occasionally it contained a normal amount of fats and carbo-hydrates, with an excess of calcium oxide. The phosphorus pentoxide in one instance was double the normal; the disease therefore was not due to want of phosphorus.

Necropsies were obtained in eighteen cases, eight of these having been seen during life. The macroscopic findings completely agreed with those of 1910. A description of these is given. As regards the microscopic appearances of the most important organs and tissues—the heart and nerves—the author writes as follows:—

"*Heart.*—The muscle fibers of the right heart are hypertrophied and the muscle nuclei are apparently increased in number. In nearly all cases the cross striations are distinct without any appearance of degeneration. In a few cases there is a slight clouding of some of the fibers. The fibers of the left heart are of normal size, cross striations are distinct and no clouding of fibers is present. Congestion is present.

"*Nerves.*—Sections from various nerves (vagi, phrenic, intercostal, and anterior tibial) were taken for staining. These were stained by Marchi's method and show degeneration of some of the fibers. The degeneration is not as extensive as is found in cases of adult beriberi but is clearly defined."

In infants sick of beriberi the author noted that improvement rapidly followed a change in diet, so he was led to the conclusion that the milk of the mother must bear some casual relation to the condition. Probably this is deleterious by reason of what it lacks rather than because of any harmful constituent. If this were true, then it would seem probable that the condition could be reproduced in laboratory animals, such as young puppies,

by feeding them with the mother's milk. The author, therefore, obtained sixteen puppies and got the mothers of the beriberic infants to nurse them. For various reasons several died, only seven being nursed for a period of one month or longer. All of these showed incoordination and weakness of the extremities, particularly of the hind legs.

At autopsy, oedema and anaemia of the subcutaneous tissues were present, and slight degeneration of the peripheral nerves was demonstrated by Marchi's method. According to the author, these findings agree entirely with the lesions obtained in infants dying of beriberi, but only one puppy showed dilatation and hypertrophy of the right heart, a feature constantly found in the human disease.

The author's conclusions are as follows:—

"1. The high infant mortality in Manila is due to infantile beriberi.

"2. This high death rate of infants is due primarily to the quality of the mother's milk.

"3. The mother's milk lacks something which is essential for the growth and development of the nerves of the child.

"4. The disease is not due to an infection or toxaemia of either the mother or the child.

"5. Another link has been added in the chain of evidence showing that beriberi is a nutritional disturbance.

"6. As a prophylactic measure, the dealers handling rice should be required to keep on hand the undermilled variety, and a campaign of education should be carried on for the purpose of enlightening the poorer classes, especially the pregnant women."

P. W. B.-S.

Thomson (D.) & Stanton (G. C.). Treatment of Beri-Beri. *Ann. Trop. Med. and Parasit.* 1912. May 29. Vol. 6. No. 1. B. pp. 53-54.

In this paper are described the results of treatment employed in the Royal Southern Hospital, Liverpool, on three Lascar firemen suffering from beriberi. During a voyage of five weeks their food consisted mostly of fish and rice, the former being bad, and the latter of the polished variety. The symptoms set in a week before admittance.

Case 1, aged 60, had well-marked mixed beriberi. The patient was placed on a full diet, with one ounce of yeast daily and katjangido beans (200 grammes). In a week the symptoms had almost cleared up and on the 18th day he was discharged with normal reflexes, walking perfectly well. Case 2, an early one without oedema, received the same treatment; improvement was marked on the sixth day and in sixteen days he was discharged. Case 3 was more severe. There was wasting, slight fever, oedema, pain, spastic gait, and increased reflexes. Similar treatment was adopted, and again in six days there was marked improvement. On the sixteenth day he was discharged apparently quite recovered.

The authors note that the improvement in these cases was very rapid. This would seem to show the marked curative power of the addition to the diet of katjangido beans and yeast.

P. W. B.-S.

MANAUD (A.). **Une Observation de Contagion du Béribéri.**—*Bull. Soc. Path. Exot.* 1912. July. Vol. 5. No. 7. pp. 514-518.

The author describes a small epidemic of beriberi in 1911-1912 in the Siamese prison of Tachim. On the fifth of August, 1911, a prisoner suffering from beriberi was brought from an infected prison at Petchaburi to Tachim; on the third of October the first case was noticed there. There were in all 37 cases out of a total of 110 prisoners, with 6 deaths. The cases were mostly of the dry form. The rice used was the polished white variety from Bangkok. From March 9th, 1912, only hand milled rice was allowed, and there were no fresh cases. Manaud states that white rice had been used in the prison for years, but there had been no outbreak of beriberi until after the importation of a case; undoubtedly however the suppression of the epidemic was due to the discontinuance of the white rice. He concludes that the causal agent of beriberi, when brought into a locality and acquired by persons there, is able to exist in a latent state. A simple saprophyte in the normal alimentary canal of man, it becomes pathogenic when he subsists exclusively on white rice. Feeding on white rice alone is not sufficient to produce beriberi unless the individual already harbours the germ. He explains the pathogenic rôle of white rice in two ways.—(1) It produces a special state of inanition through "deficiency." (2) The starch becomes in the intestine a favourable medium for the development of the germ and for the production of its toxin.

[Up to the present no definite germ or toxin has ever been demonstrated in beriberi, and the occurrence of the first case at Tachim three months after the arrival of the infected man was probably fortuitous.]

P. W. B.-S.

BROWNING (H. G.). **Etiology of Beri-Beri.** [Memoranda.]—*Brit. Med. Jl.* 1912. July 13. p. 69.

The author briefly points out that food apparently played only a small part in the causation of an outbreak of beriberi in a ship to which he was attached. There was a native crew of Calcutta Indians, consisting of 29 deck, and 52 engine room hands. All had exactly the same food, flour, rice-meal, and vegetables, and there were no complaints as to its quality. The deck crew slept in a dry compartment forward; the engine room hands below, where it was often very damp. Among the engine room hands, there were six cases of beriberi and nine suspected cases; the deck hands were quite free.

[There is no doubt that in ships the hard work, and the conditions under which the engine room hands live, predispose to the development of any debilitating disease, notably beriberi.]

P. W. B.-S.

SURVEYOR (N. B.). **Notes on the Treatment of Beri Beri.**—*Trans. Soc. Trop. Med. and Hyg.* 1912. July. Vol. 5. No. 8. p. 364.

Surveyor gives a short description of a severe case of beriberi, treated in the "J. J. Hospital" at Bombay by an alcoholic

extract of rice waste dissolved in glycerine, called locally "Konda"; calcium glycero-phosphate was also given. There was marked improvement after the third injection of the extract.

P. W. B.-S.

LAWS (C. E.). **Beriberi among the Filipinos.** [Correspondence.] —*Jl. Amer. Med. Assoc.* 1912. Aug. Vol. 59. No. 6. p. 463.

This letter describes the author's experiences while practising for some years in the Philippines, before white rice had been demonstrated to be the important factor in the etiology of beriberi. He notes that the very poor were least affected, for they cleaned their rice in a crude fashion and did not destroy all the pericarp, while the rich always had fine white rice. The steps then taken to eradicate the disease were segregation, and dietary and medicinal treatment. It was impossible to exclude rice altogether, but native cleaned rice was substituted for white rice, and beans and native peas (*Phaseolus mungo*) were added, the latter acting almost as a specific in certain cases.

P. W. B.-S.

SHIGA (K.). **Ein epidemieartiger Kakke- (Beriberi-) Ausbruch in einem Gefängnis in Korea. (Ein Beitrag zur Entstehung der Kakke.)** [An Epidemic of Beriberi in a Prison in Korea.]—*Arch. f. Schiffs. u. Trop. Hyg.* 1912. Aug. Vol. 16. No. 15. pp. 522-526.

The author gives a description of an epidemic of beriberi which was discovered in a prison in Korea. It began in May, 1911, and ended on June the 19th. The number of cases was 97, or 35 per cent. of the inmates, and all were Japanese. On investigation, the hygienic conditions of the prison were found very nearly perfect. There was no beriberi in the town, so that infection could not have been brought from without. Sporadic cases had occurred in the prison previously (7 in 1910). Five men, who had suffered in the previous year, were still present when the epidemic broke out, and might have been "carriers" of the hypothetical excitant of the disease; but this was unlikely as females, with whom these men never mixed, were affected also.

The staple food was four parts of polished rice and six parts of barley. Previously, when rise only was given, beriberi had been very common, but all agreed that with the new dietary it had greatly diminished. The prisoners received food in accordance with work done, and most beriberi cases occurred in those who had the lowest grade of diet. The author gives tables of weights, diet, and work which show that those prisoners who had been losing weight before the epidemic were mostly affected, and it was noticed that these showed early gastro-intestinal disturbances. 48 per cent. of the cases were in the non-workers who never moved about; this circumstance, with the mental discomfort and the bad air in the cells, must have favoured nutritional disturbances.

The author draws the following conclusions:—The study of the epidemic does not supply a single fact in support of beriberi being

an infectious disease, but furnishes various factors favourable to the defective nutrition view (confinement in cells, want of open-air exercise, etc.). It is questionable whether there is any form of beriberi attributable to an infectious agent; probably, as NOCHT has shown, the so-called "infection" in any instance will not stand a careful enquiry.

P. W. B.-S.

GOUZIEN (Paul). **Le Béribéri au Tonkin.**—*Ann. d'Hyg. et Méd. Colon.* 1912. July-Sept. Vol. 15. No. 3. pp. 445-491.

The author describes, in a long paper, an epidemic of beriberi which occurred in the Civil prison at Hanoi. He gives fully the main centres of the disease in Tonkin, and finally discusses the etiology of the disease and prophylactic measures. In Hanoi the prison is a comparatively new one, but it is badly placed in the centre of the town and is very damp. The disease chiefly affected the men soon after being admitted to the prison, and especially those who had the least liberty. The onset was generally sudden. The epidemic ceased abruptly when white rice was replaced by hand milled rice, together with a varied fresh diet and improved sanitation. Six weeks afterwards symptoms of scurvy appeared in 64 cases, exclusively in those who had previously suffered from beriberi, and apparently due to their returning to the old diet. The second outbreak also quickly disappeared when the cause was removed.

The beriberi centres in Tonkin were scattered on the low ground throughout the delta, the disease affecting the inmates of schools, prisons and barracks. It was always most prevalent in the wet season, attacking mostly the young robust newcomer. The author considers that excessive humidity plays a double role: (1) It acts on the rice grain, depriving hand milled rice of its protective properties and rendering it toxic; (2) It causes a diminution in the resisting powers of the patient. When rice is kept in damp store houses it very rapidly spoils, and its use is followed by an outbreak of the disease, especially when the dietary is deficient in fresh food.

The author compares beriberi with haemoglobinuric fever: in the latter the soil is prepared by previous attacks of malaria, the onset being provoked by cold, etc.; in the former the soil is prepared by a defective diet, the beriberi syndrome being produced by different effective causes, isolated or associated, as humidity, over-crowding, insufficient food, mental conditions, or the ingestion of large doses of the neurotoxic substances, the disease being able to exist in a latent state for some time. From his observations in Tonkin he believes that beriberi is an intoxication, not an infection, a toxin formed in the food being absorbed with it. He draws attention to the frequency with which scorbutic symptoms alternate with those of beriberi, or are evolved side by side with them. The author also discusses the possibility of the disease being due to an anaphylactic action of a toxic food, and whether the incompletely decorticised rice exerts an antitoxic effect.

The prophylactic measures recommended are dietetic and hygienic, and isolation of the cases.

[The close relationship of beriberi and scurvy in this district is of considerable importance, as is also the marked loss of protective power of the non-polished rice from the excessive humidity; but there is no definite proof of any toxin formation in the grain nor of intoxication in the patient, the observations being compatible with the view that the disease is caused by a deficient dietary with which certain predisposing factors are associated.]

P. W. B.-S.

FARGIER. **Béribéri et Riz fraîchement décortiqué.** *Ann. d'Hyg. et Méd. Colon.* 1912. July-Sept. Vol. 15. No. 3. pp. 491-497.

The author gives a short account of an epidemic of beriberi which occurred among Annamite troops near Saigon. It steadily increased from 1907 to 1910. In 1909 there were 174 cases with 16 deaths. In June of 1910 there was a local enquiry and great changes in the food supply were made. Red rice was substituted for white, and fresh fish with vegetables for dry fish. The epidemic ceased at once.

P. W. B.-S.

SHIBAYAMA (G.). **Bericht über die Beriberiepidemie bei den Auswanderern auf dem Dampfer "Kaspelas."** [An Epidemic of Beriberi among Emigrants on the Steam Ship "Kaspelas"]—*Arch. f. Schiffs- u. Trop. Hyg.* 1912. Nov. Vol. 16. No. 21. pp. 721-731.

The steam ship "Kaspelas" left Yokahama with 664 emigrants on September 26th, 1908, arriving at Callao, Peru, on November 10th. Of these, 62 returned to Japan, arriving there on February 11th after a very bad passage of 139 days.

The first case of beriberi was found on December 21st. The numbers increased until all were affected. Five died on the passage, and one at Yokahama. The author found 25 patients in hospital and 10 others slightly ill; the remainder could not be traced. The hygienic condition of the ship and the water supply were moderately good. The rations consisted mostly of rice, but a moderate amount of condiments, fresh meat, and fish were given from time to time. Full tables of the dietary from December to February are given. There were, however, many complaints about the food, though this appeared sufficient. On the way out Japanese rice was used and there was one doubtful case of beriberi which recovered. On the way home Peru rice was supplied, but this it is stated could not have been the cause of the epidemic, as 6 Japanese employed in the kitchen and 38 Chinese sailors and stokers, who used it, were unaffected. [The preparation of the food and living conditions of these were probably different from those of the emigrants.]

Full descriptions of three cases are given. These were of the ordinary wet form. The author, after discussing the various

factors, comes to the conclusion that deficiency in the diet was not alone sufficient to cause the epidemic, for with an increase in the dietary the beriberi continued. In his opinion the disease in East Asia comes on after deterioration of health by exhausting conditions, and bears some relationship to locality, requiring some unknown active agent as the exciting cause.

P. W. B.-S.

PREVENTION.

FRASER (H.) & STANTON (A. T.). **The Prevention of Cure of Beri-Beri.**—*Lancet.* 1912. Oct. 12. pp. 1005-1007.

The authors take it as proved that beriberi and polyneuritis in birds are due to the deficiency of a substance in food, and that rice is rendered harmful by the milling and polishing process which deprives it of some essential property.

Harmful and harmless rice can readily be distinguished by inspection, but it is very desirable that there should be some chemical method of standardisation by which a sample can be tested as to its fitness for food. The estimation of the phosphorus pentoxide they consider is the most satisfactory test; the presence of 0·4 per cent. can be used as a safe, practical, and fair indicator. The estimation of fats and proteids, which are also contained in the sub-pericarpal layers, is more difficult and less reliable. They consider that any hasty legislation or taxation of the polished rice would probably defeat its object, but the gradual education of the people to the advantages to be derived from the use of unpolished rice is most necessary; even now some Chinese employers are taking an active interest in doing this. In 1911 there were admitted into the Government hospitals of the Federated Malay States no less than 5,340 cases of beriberi; prophylactic and curative measures are therefore urgently needed. The authors, believing in the similarity of the two diseases, carried out a number of experiments on fowls fed on polished rice, to test the prophylactic and curative powers of extracts which they prepared from rice polishings. The results were most satisfactory. Two drams of the effective liquid extract represented two ounces of fat-free polishings, the daily dose for an adult beriberi case. In old cases long treatment would be required. With favourable conditions the addition of the extract to the food of the patient will materially hasten his recovery.

P. W. B.-S.

SCHÜFFNER (W.) & KUENEN (W. A.). **Über den Einfluss der Behandlung des Reises auf die Beriberi und die daraus entstehenden Fehlerquellen bei der Beobachtung.** [Influence of the Treatment of Rice in the Causation of Beriberi and the Sources of Error that thus arise.]—*Beihefte zum Arch. f. Schiffs- u. Trop. Hyg.* 1912. Oct. Vol. 16. Beiheft 7. pp. 5-30. [575-600.]

The authors state that though the rice theory gains ground steadily certain people do not accept it, because in a given population eating the same rice as a staple food some are affected

while others remain free. They give an instructive case bearing on this point: a worker in a hospital was alone attacked with beriberi, though supplied with the same rice as all the others; it was found that before use he submitted it to fresh pounding, removing the remainder of the outer covering of the grain with its protective properties. The authors have studied the manufacture of rice from the time of harvesting to that of its use as food. They state that it is very difficult to make coolies eat any other than polished rice. "Cured" or parboiled rice (BRADDON) keeps best, as the method preserves much of the cuticle; but all samples are not of uniform character, some being quite deficient in cuticle and having therefore a low P_2O_5 index. This indicates that some samples of so-called "cured" rice may nevertheless be dangerous. The fact that "cured" rice is sometimes associated with beriberi negatives the living infective agent theory held by some.

The authors then give their method of estimating the P_2O_5 in various samples of rice, which varies from ·9 per cent in cargo rice to ·01 per cent. Native prepared rice had ·65 to ·54 per cent., Rangoon or coolie rice as used at Deli ·42 to ·46 per cent. (very near FRASER's ·46 per cent limit). Siam and Java rice was much lower and dangerous. Rangoon rice often produces beriberi but not if the P_2O_5 is above ·46 per cent. It is not necessary to reach the high standard of village rice (·6 per cent.) to obtain absolute safety; 0·5 per cent. would be enough and would not affect the preserving qualities of the grain or be opposed by the people; this standard should be fixed by law.

Much washing reduces the protective power of rice, but "cured" rice loses less than others; steaming and boiling has the same effect, by destroying the cuticular layers. The authors state that the custom of drinking the rice washings practised by Malays, Javanese, and Chinese is advantageous, but in prisons this valuable material is thrown away; and so prisoners frequently suffer. KOHLBRUGGER's theory that washing the rice is likely to be beneficial is strongly criticised. The authors' view differs from that of FRASER and STANTON; they do not consider the 0·46 per cent. P_2O_5 standard of raw rice as the ultimate criterion whether or not beriberi will be produced, but that this depends on the subsequent treatment of the rice. An instance is given in illustration. At two prisons in Deli, one, Lubag Pakhan, was rarely, the other, Medan, commonly affected. On investigation it was found that at the latter the rice was steamed and thoroughly washed when half done, while in the former it was boiled in a large iron vessel with just sufficient water. The greater healthiness of the former, generally put down to situation, soil, etc., was really due to the better preparation of the rice.

The immunity among the Javanese is due to the fact that they have a more liberal diet; they eat the same rice as the Chinese, but take more fruit and vegetables. The newly arrived Chinese suffer most, being ignorant of the produce of the country. Many facts are brought forward to show that both the age of the rice and long storage is detrimental, and that the older the rice the whiter it can be pounded. The danger is not due to the presence

of a poison, but to the absence of an essential part of the rice grain. The main facts are thus summed up—

(1) Beriberi is due to a deficiency of unknown substances utilised in the body as building material for the nervous system, or necessary for the maintenance of internal secretions.

(2) Rice eating nations should draw these substances from the silver cuticle of the rice, especially the aleurone layers.

(3) A criterion of the presence of the essential substances is the phosphorus content.

(4) Factory milled rice may be obtained with all degrees of P_2O_5 constituents, the highly polished rice causing beriberi if other food stuffs do not compensate.

(5) The final value of the rice depends not only on the amount of polishing, but on methods of washing, cooking, and storage. Purchasing the same kind of rice does not, therefore, mean eating the same kind.

For prevention, the author lays stress upon (1) Rice reform, with a minimum legal limit of 0·5 per cent. P_2O_5 for the dry substance; (2) If this is not imposed, substitution of other foods to make up the important deficient ingredient; (3) A strict control of all samples of so-called "cured" rice.

P. W. B.-S.

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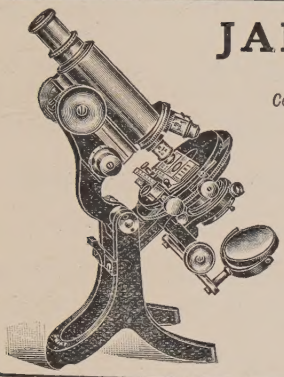

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